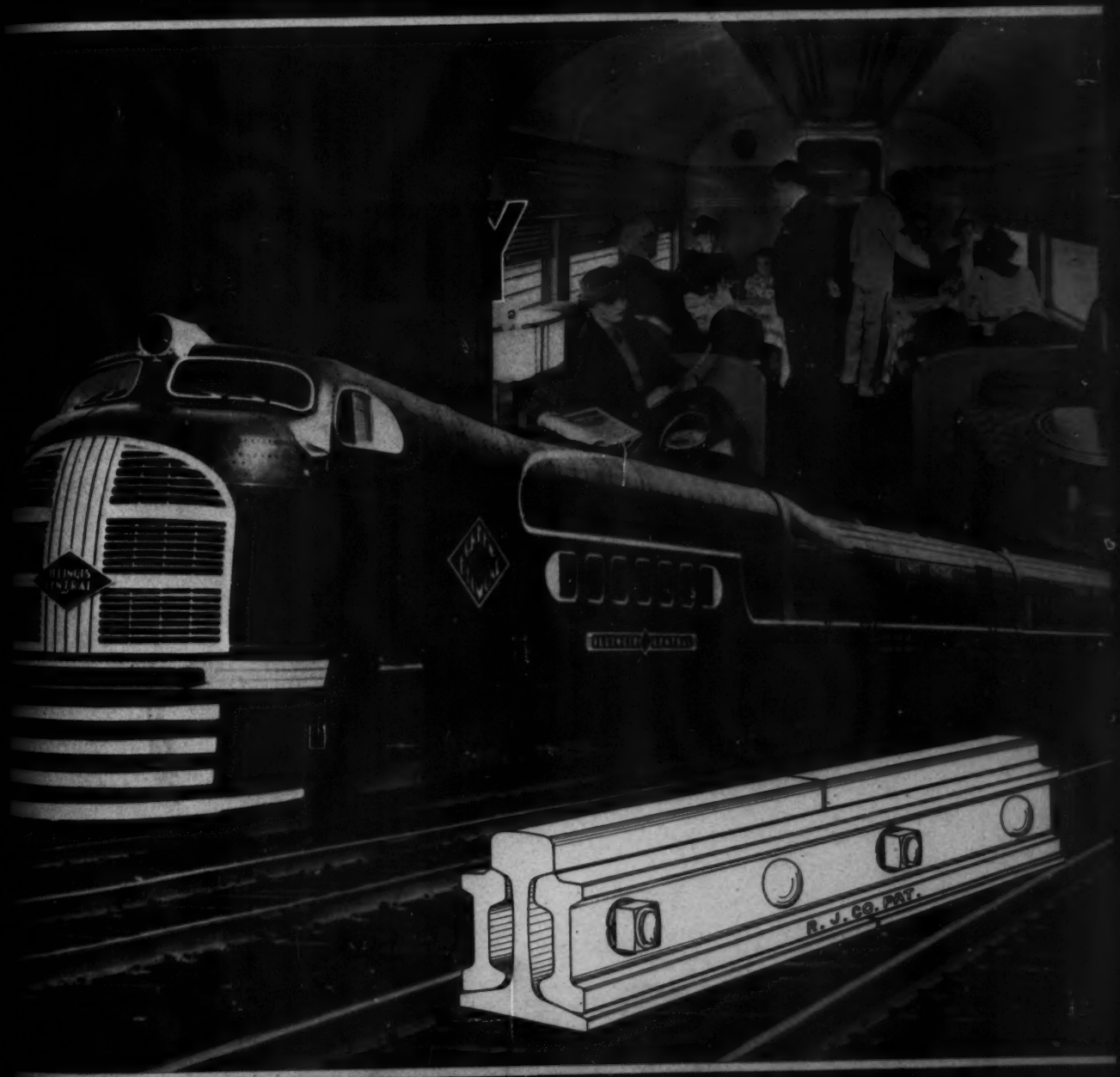

R. J. CO. PAT.

Reliance HY-CROME *Spring Washers*

DEPENDABILITY

• The new high speed, streamlined trains of today represent definite progress in railway transportation. To accommodate modern motive power and car equipment—road bed, track structure, signal equipment and accessories must keep pace. The Reliance HY-PRESSURE HY-CROME spring washer is our newest contribution to a more economical, efficient and safer track joint condition, representing dependability of product and service. Maintenance-of-Way officials can verify our claims.

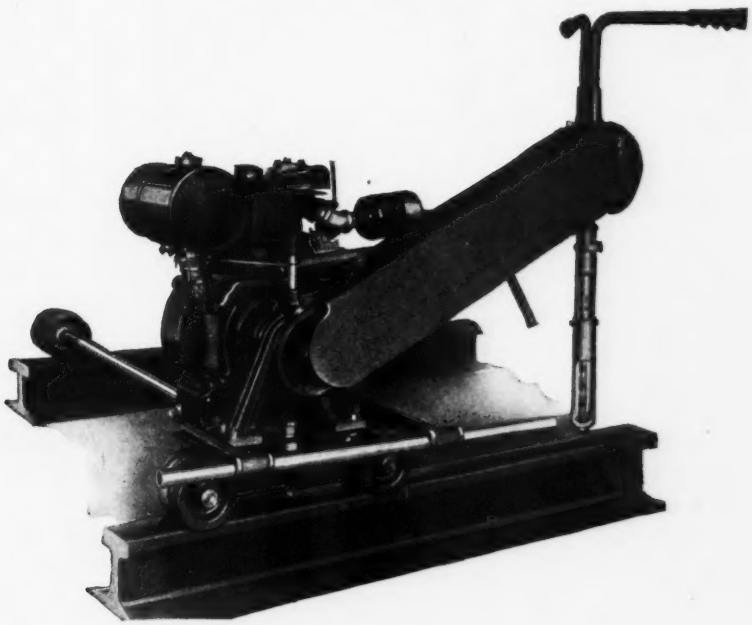
EATON MANUFACTURING COMPANY
RELIANCE SPRING WASHER DIVISION
MASSILLON, OHIO

HY-PRESSURE HY-CROME
Edgemark of Quality

Streamliner "City of Denver"
UNION PACIFIC RAILROAD COMPANY
Daily—Chicago and Denver—16 hours

Photo by HARPER

Raco Tie Boring Machine



Bores ties more than twice as fast as any other accepted means . . . Bores holes absolutely vertical . . . Locates all holes exactly in center of tie plate punching . . . Automatically controls depth of hole . . . Chips are blown away from hole as fast as made, leaving hole clear . . . One-man operation . . . Operator works in an erect position . . . The machine pushes or pulls along track with a pressure of five pounds . . . It can be removed from track by one man.

For Screw Spiking use Raco Tie Borer in conjunction with Raco Power Track Machine equipped with Screw Spike Chuck Unit. This combination of light, mobile units affords the most rapid, accurate and economical means of boring for and setting Screw Spikes to a uniform holding tension.

Boring holes for Cut Spikes has these decided advantages over old inaccurate methods of driving:

Greater holding power . . . Wood fibre undisturbed . . . Tie splitting eliminated, therefore retarding decay . . . Spikes always centered and vertical . . . No thrust against plates to ultimately cause spreading or pinching of track gauge . . . Fast and easy driving . . . Application of creosote to spike holes and minimizing tie plate wear.

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE

405 LEXINGTON AVENUE

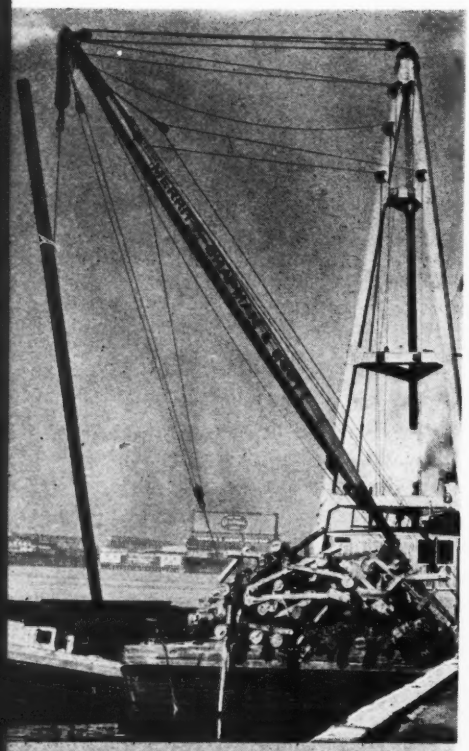
(Chrysler Building)

NEW YORK

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

Over 1 Million F

Since January 1935, more than 1,000,000 feet of USS Steel Bearing Piles have been driven in 152 projects



FAY, SPOFFORD & THORNDIKE *and the Massachusetts Dept. of Public Works designed an interesting construction using clusters of USS Steel Bearing Piles capped with steel-and-concrete cylinders to replace damaged wooden piles under Boston's immense Commonwealth Pier. In this photograph you see how easily the contractors, Merritt, Chapman & Scott, handled the longest single length bearing pile ever driven, 128'6" long.*

LESS DISPLACEMENT *and disruption of the soil is an important advantage of USS Steel Bearing Piles. It explains the easy penetration and close spacing possible. The high moment of inertia provides the high rigidity and high load-carrying capacity.*

FOR more than forty years various combinations of steel sections have been used as bearing piles with entire satisfaction.

But within the last three years there has been an especially rapid increase in the use of steel bearing piles. This trend has been accelerated by the important disclosure that steel pile sections buried twenty-five years show practically no deterioration . . . and by the introduction of the more efficient wide-flange CBP section — USS Steel Bearing Piles.

These new bearing piles have been driven in a wide variety of projects. Large jobs and small jobs. Fresh water and salt water. Under buildings, bridges, viaducts, dams and docks. The longest single length pile ever driven (128'6") is a USS Steel Bearing Pile in the new foundation of Boston's immense Commonwealth Pier.

USS Steel Bearing Piles offer many advantages. They can support unusually heavy loads per pile. They can carry high bending stresses. They can act as columns of trestle bents. They effectively resist lateral displacement. They penetrate with remarkable ease through all types of sub-strata soil—deep alluvial deposits, tough shales, hard clays, coarse gravels, debris, old timbers, etc. They make possible the reconstruction of bridges and trestles in place, without interruption to traffic.

In general, USS Steel Bearing Piles offer higher bearing capacities — and they are more easily handled and driven — than any other form of bearing pile available.

U·S·S STEEL BEARING PILES

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES

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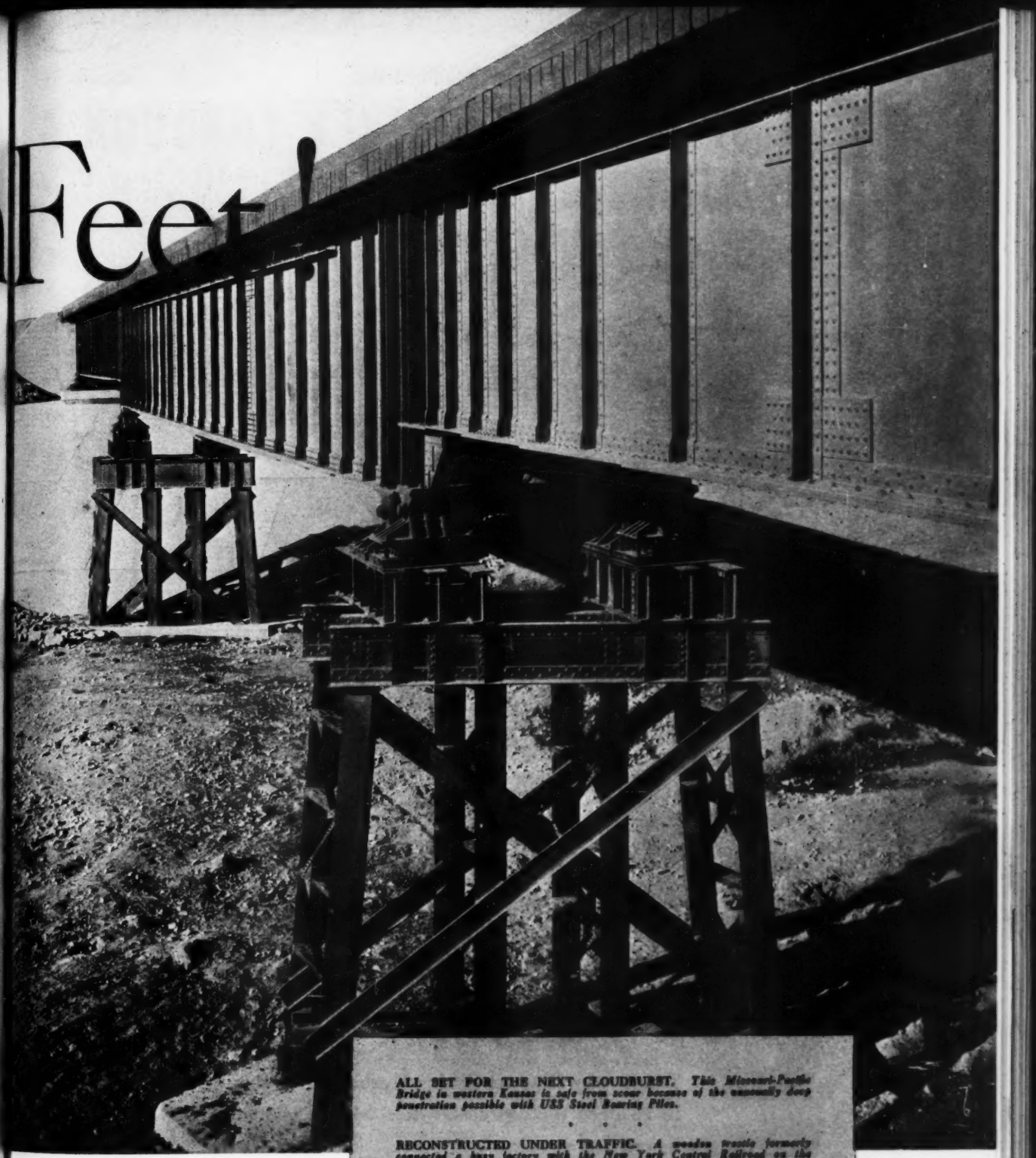


ALL SET FOR THE NEXT CLOUDBURST. *This Missouri-Pacific Bridge in western Kansas is safe from scour because of the unusually deep penetration possible with USS Steel Bearing Piles.*

• • •

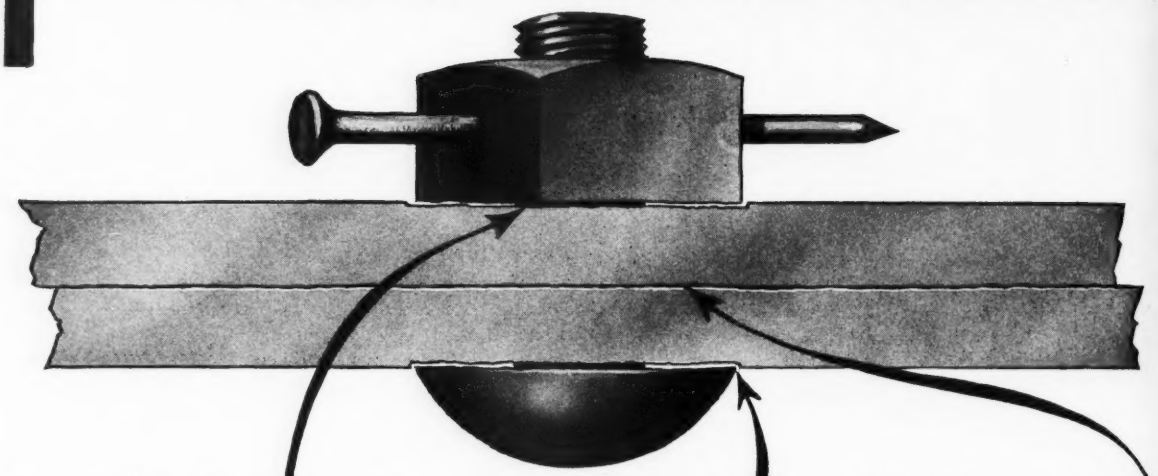
RECONSTRUCTED UNDER TRAFFIC. *A wooden trestle formerly connected a busy factory with the New York Central Railroad on the opposite side of Crab Creek. The ease of driving USS Steel Bearing Piles made it possible to build this all-steel trestle in place with no interruption to switching movements. Notice the strong low-cost abutment wall of USS Steel Sheet Piling.*

ENGINEERING COOPERATION

Since new developments are frequent and the application of steel bearing piles is sometimes rather technical, we offer you the helpful cooperation of our staff of piling specialists — engineers as thoroughly familiar with steel bearing piles and their application in many fields as you are with the problems of your own job. Together, you and a Carnegie-Illinois piling specialist can perhaps achieve savings in money and improvements in design which neither could achieve alone. Call on us freely for this kind of earnest side-by-side cooperation.

USS

IF A SPIKE WERE DRIVEN THROUGH A TIGHTENED NUT and BOLT—THROUGH BOTH —SO THE NUT COULD NOT TURN LOOSE



then vibration would cause wear and inevitable looseness HERE and HERE and HERE

...how could it help it?

1
IMPROVED HIPOWER

2
DOUBLE HIPOWER

3
NATIONAL RIB WASHER

4
ANKOR HIPOWER

5
NATIONAL COLLAR GROOVED

6
THACKERAY SPRING WASHER

ONLY A SPRING WASHER CAN COMPENSATE FOR SUCH WEAR BY EXPANDING AND MAINTAINING BOLT TENSION UNTIL THE TRACK MAN COMES AGAIN..*only a spring washer!*

That is why Hipower Spring Washers more than pay for themselves in reduced upkeep costs—less labor and maintenance—fewer renewals and repairs.

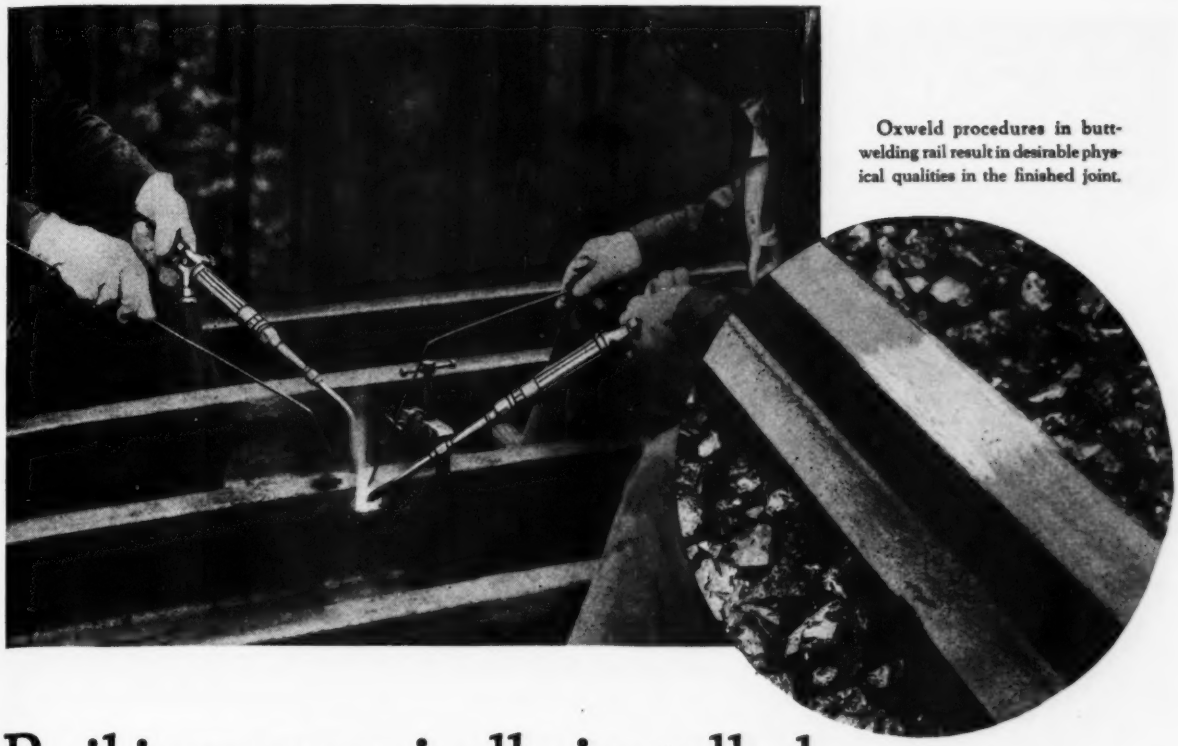
Hipowers prolong the life of rail and of all joint parts.

Hipowers give an added safety factor to track.

Over 50 years of research and improvements—over 50 years of tests and trials—over 50 years of widespread use by leading railroads prove our spring washers to be one of the best railroad investments.

THE NATIONAL LOCK WASHER COMPANY, Newark, N. J.

Spring Washers • Retaining Rings • Drop Forgings • Car Window Equipment • Railway and Bus Windows



Oxweld procedures in butt-welding rail result in desirable physical qualities in the finished joint.

Rail is economically installed by Butt-Welding under Oxweld Procedures

RAIL of all weights, which has been butt-welded into various lengths by the oxy-acetylene process under Oxweld procedures, has given satisfactory service for many years.

Rail through platforms, road crossings, motor car setouts and other locations where joints are difficult to repair is regularly butt-welded on many railroads. Also, through several railroad tunnels, the rail has been butt-welded into continuous lengths. This has eliminated joint maintenance and added years of service life to the rail.

A great deal of interest in continuous welded rail has been shown by railroads throughout the country during recent years. As a result of this interest, Oxweld Railroad Service, with the co-operation of Union Carbide and Carbon Research Laboratories, Inc., has developed a procedure that assures a weld that is comparable with the original rail.

The Oxweld Railroad Service Company offers this procedure to its contract roads. For full advice regarding the adaptability of butt-welding to current programs of rail laying, consult Oxweld.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

New York: Carbide and Carbon Building
Chicago: Carbide and Carbon Building

Visit the Oxweld Exhibit
Booths 90 and 91
Roadmasters' Convention
Stevens Hotel, Chicago
September 14-16, 1937

OXWELD RAILROAD SERVICE

1912-1937

A QUARTER OF A CENTURY OF SERVICE
TO THE MAJORITY OF CLASS I RAILROADS

to railway supply manufacturers

WAS DAD WRONG ?

When teacher told Johnny that dad's answer was not the correct answer, she ventured into debatable territory for—

that's the amount that the railways are spending *this year* for the maintenance and improvement of their bridges, buildings and water stations.

that's the amount that is being spent *this year* under the direction of the men who will attend the convention of the American Railway Bridge and Building Association at Chicago on October 19-21 — chief engineers, engineers maintenance of way, bridge engineers, engineers of buildings, engineers of water service, division engineers, supervisors of bridges, buildings and water service, etc.

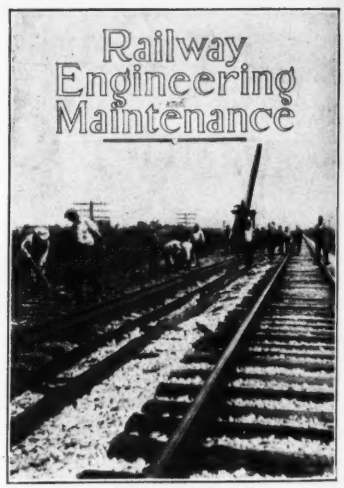
This *100 million dollars* is going for roofing, paint, water-proofing, insulation, pipe, plumbing and heating equipment, tanks and the myriad of other materials that are required in the repair and reconstruction of the more than 5,000 miles of railway bridges, the 350,000 railway buildings and the 18,000 railway water stations.

Railway Engineering and Maintenance serves these men *every* month. It will give them *special* attention in November through

(a) the inclusion in a special advance edition, for distribution at the convention, of all of the reports that are to be presented at that convention—the only form in which these reports will be available, and

(b) the inclusion, with those reports, of the discussions and other developments at the convention, for distribution to all subscribers after the meeting adjourns.

This issue, with its double service, offers an unusual opportunity to manufacturers of bridge, building and water service materials and equipment to tell their story to these men when they are most receptive—and to sow the seed for next year's sales in the most productive season for planting.



ARRANGE NOW FOR REPRESENTATION

•

FORMS CLOSE OCTOBER 10

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

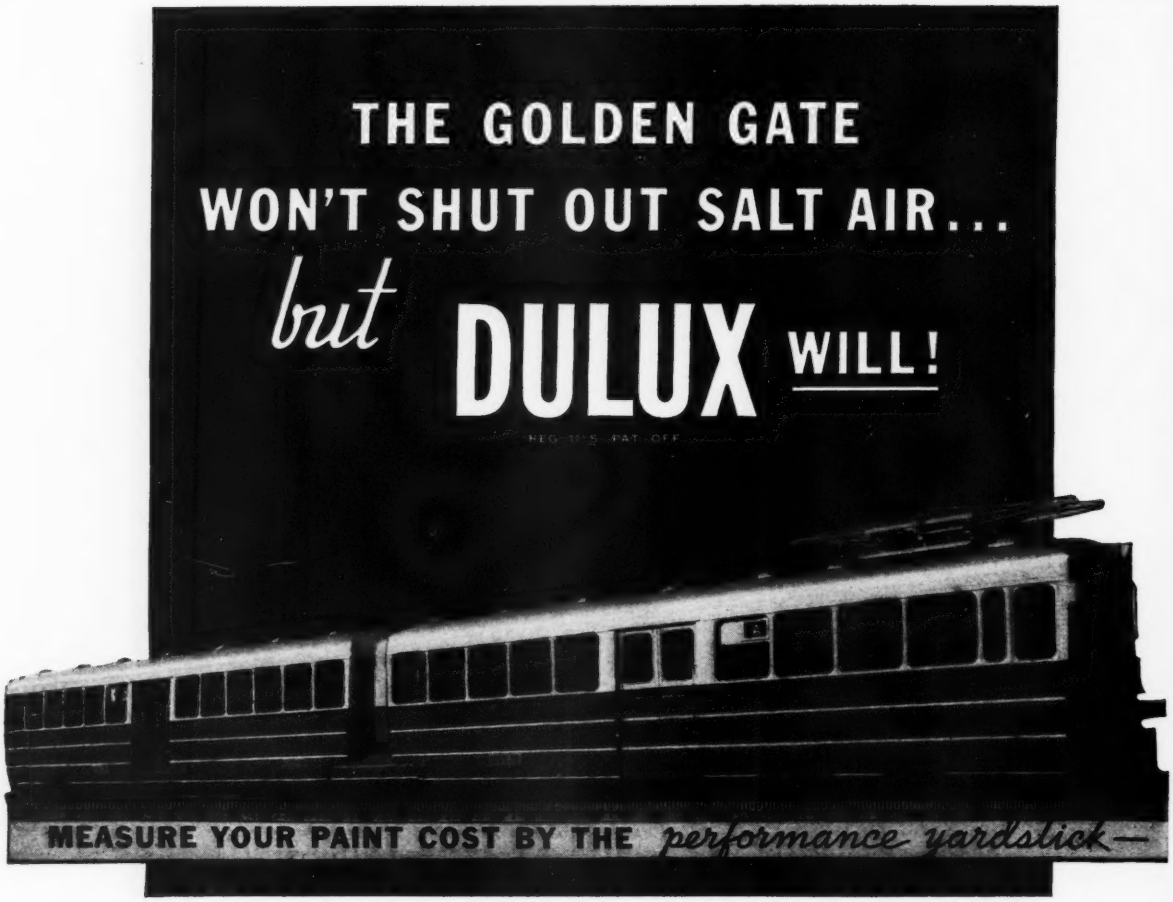
IF, as authorities agree, approximately 50% of track maintenance can be saved by eliminating rail joints, an entirely new picture of operating costs becomes apparent. For example, RAILWAY AGE reports that Class 1 railroads spent $456,000,000.00 in 1936 for maintenance of way. Assuming, as has been estimated, that 60% of this expenditure, or $273,000,000.00 was chargeable to track upkeep, the possible saving for last year was $136,000,000.00; an amount equal to more than 3% of the year's total operating income for all Class 1 roads combined.

There is nothing fantastic or beyond achievement in the idea of effecting such savings through the use of continuous rails. Nor should the complete elimination of rail joints by means of welding be regarded as something which may evolve years hence. Right now, in this country, long Thermit welded rails, including jointless stretches up to 7000 feet in length, are giving good accounts of themselves; in some cases after four years of service in main line track. And, from the knowledge and experience gained through these early trial installations, the Thermit Rail Weld is rapidly being developed to a point well beyond the experimental stage.

Executive engineers and management officials are invited to write for a comprehensive illustrated report giving details of the Thermit welding process and describing more fully the installations to date.

THERMIT Rail WELDING

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.
ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO



One reason why Key System Trains are finished in "Dulux"

CALIFORNIA sunshine and salt air mean something different to a railroad man than to a tourist bureau. For from the ocean blows in salt —penetrating, rusting, corroding!

Day after day these sleek, "DULUX"-finished, two-car, Key System trains will cross the San Francisco-Oakland Bridge, from Oakland to San Francisco. They are always exposed to the rigor of California sunshine and Pacific salt winds. But "DULUX" resists the elements. This fact has been proved time and again under conditions that duplicate those prevailing here. Its impermeability to salt air, fog, hot suns and its resistance to mechanical injury save money. It lasts longer and retains its original, beautiful lustre.

By the performance yardstick "DULUX" is much cheaper in the long run! Our representative will show you how "DULUX" cuts down your paint bills. E. I. du Pont de Nemours & Co., Inc., Finishes Division, Wilmington, Delaware.

DU PONT
REG. U. S. PAT. OFF.

TRANSPORTATION FINISHES

Neat appearance, in keeping with the architecture of the buildings, influenced the use of Hayes Type WD Bumping Posts here. This new Hiram Walker plant cost millions and is the largest of its kind in the world

The price was hardly considered in ordering these posts; but if it had been, the buyer would have found that they cost no more than other posts.

Examine a Type WD critically. Notice that there is not an ounce of grey iron in the post. Grey iron has low tensile strength and fractures too readily to have any proper place in a bumping post. Every part of WD is made of mild rolled steel, forged to form where special shapes are needed.

The only exception is that the eight bolts which tie the post to the rails are not mild steel but SAE 3135 chrome nickel steel, heat-treated, with double the strength of ordinary bolts.

It is this careful design and attention to every detail which has produced a post with no excess weight and with lines as trim as a thoroughbred.

Add the middle rails to strengthen the track and you have a modern and efficient installation.

Hayes Track Appliance Co., Richmond, Indiana

Here are two features of the NORDBERG CUP WHEEL PRECISION GRINDER

Greatest accuracy when grinding rail

• • • •

Adaptable to track under heavy traffic

When grinding welded rail, no grinder is comparable to the Nordberg Precision Grinder for accuracy and smoothness of the job. It is also fast and convenient to operate. Where grinding is done under heavy traffic, two men can easily set the machine in the intertrack space. Its compact design allows ample clearance for passing trains.

For removing mill tolerance of newly laid rail, or for taking out corrugations, this cup wheel grinder has advantages over any other type of grinder. With the power takeoff and flexible shaft, the Precision Grinder can be used with the many attachments developed by Nordberg for beveling rail ends, grinding frogs, switch points and crossing flangeways, removing flow from stock rails, etc.

NORDBERG TRACK TOOLS

Precision Grinder	Adzing Machine
Surface Grinder	Spike Puller
Utility Grinder	Power Jack
Power Drill	Track Wrench

Track Shifter

1 With the grinder mounted on the stabilizing frame, the machine is rocked back and forth when grinding welded rail.

2 Here the grinder rides on flanged rollers and without stabilizing frame for quick removal when working on "hot" track.

3 With flexible shaft attachment, can be used for beveling rail ends and a wide variety of grinding jobs.

NORDBERG MFG. CO.
MILWAUKEE, WIS.

UNBIASED RECOMMENDATIONS

. . . the Result of

COMPLETE WELDING SERVICES

AIRCO'S leadership in the fields of both oxyacetylene and electric arc welding—each of which has its own sphere of greatest usefulness—makes possible a complete service to the railroads that is unique and of unusual value—unbiased recommendations are assured.

In building and bridge repairs or on the track—whatever the job—time-proven methods and equipment are offered that best meet the requirements of any welding problem.

- AIRCO oxygen, acetylene, operating equipment and engineering are accepted as standard, in the field of gas welding and cutting, by many railroads.
- In the field of electric welding WILSON Arc Welders, distributed solely in the United States by AIRCO, are widely accepted as superior products.

Call upon us for unbiased recommendations that assure maximum economy and best results—whatever the welding job may be.

AIR REDUCTION

SALES COMPANY

General Offices: 60 East 42nd Street, New York, N.Y.

DISTRICT OFFICES in PRINCIPAL CITIES

A NATION-WIDE WELDING and CUTTING SUPPLY SERVICE

EVEN IN TIMES OF EMERGENCY

You Can Depend on Armco Culverts

After the Flood: **Just 2 hours and 15 minutes was required to place this twin 72-inch Armco culvert, bolt the connecting bands and begin backfilling.**

CHECK THESE ADVANTAGES

1. Less subject to damage by high velocities, undercutting, and soft, shifting foundations.
2. In case of washouts, Armco pipe generally can be hauled back into place and reinstalled without serious damage.
3. Prompt delivery and quick, easy installation of Armco pipe helps you save time and money on emergency replacements.

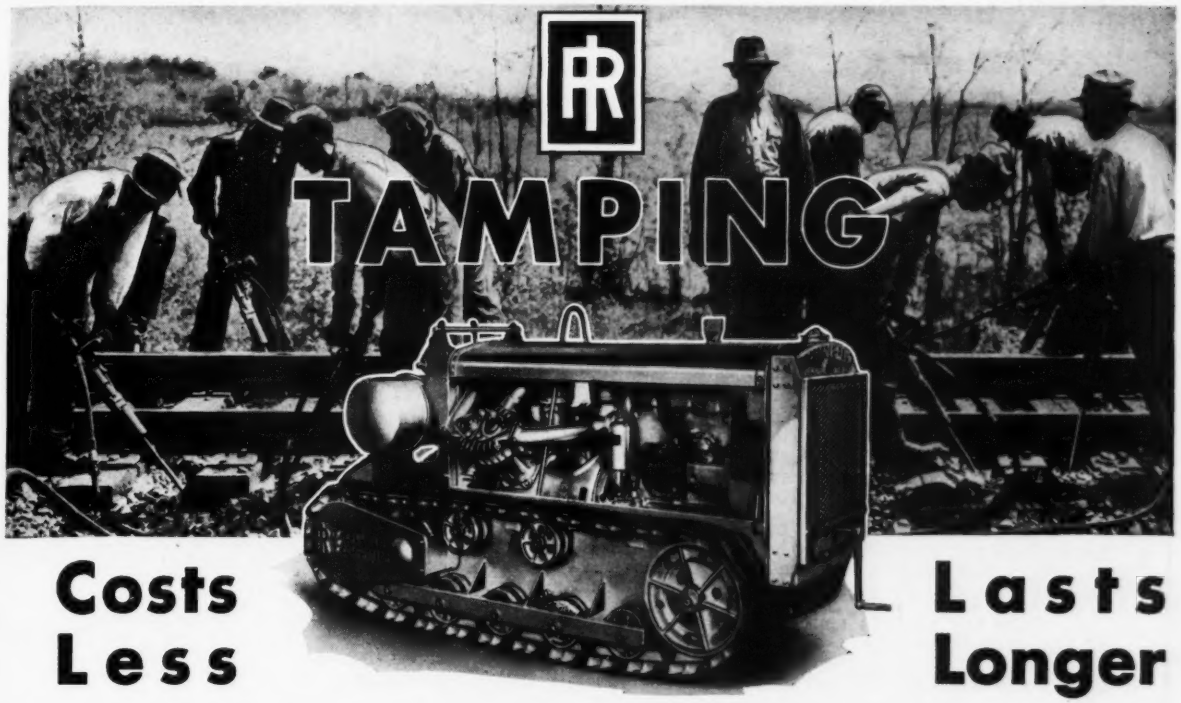
Floods . . . fires . . . and earthquakes simply emphasize the superior reliability and economy of corrugated metal drainage structures.

Even when subjected to the severest conditions, these sturdy, flexible drains come through with *less damage and greater salvage value* than any other type of drainage structure. On emergency replacements, too, the prompt delivery and quick, easy installation of Armco pipe enables you to restore normal schedules with the least delay.

Reap these important advantages in all your drainage construction by demanding *Asbestos Bonded* Armco pipe. Our nearest office is ready to give you capable and helpful assistance. Ingot Iron Railway Products Co. (Member of the Armco Culvert Mfrs. Assn.) Middletown, Ohio • Berkeley, California Philadelphia • Dallas • Atlanta • Salt Lake City • Minneapolis • Los Angeles • St. Louis • Portland Cleveland • Spokane • Chicago Richmond • Houston • Denver.

ARMCO

ASBESTOS BONDED • ARMCO PAVED INVERT PIPE



Costs Less — Lasts Longer

Ingersoll-Rand MT-3 Pneumatic Tie Tampers speed up track maintenance. More ties are tamped and with far less energy at less cost. Four men will tamp as much track as 12 to 14 men with picks or bars — and do a far better job.

The ballast is compacted under the ties with greater uniformity—water pockets are eliminated—the track retains its alignment much longer—all essential track requirements for higher train speeds and heavier axle loads.

Greatest overall economy is achieved when the low-air consumption I-R Tie Tamper is used in conjunction with the I-R two-stage air-cooled Air Compressor. I-R Compressors deliver 23% more air and save 25 to 65% fuel costs per cubic foot of air. They are furnished with gasoline or oil engines in various capacities and different modes of transport.

For complete information regarding I-R cost-reducing equipment, write to any of our district offices.

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538-11

No. 105 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: How Articles Are Written

September 1, 1937

Dear Reader:

"How do you go about it to write the articles that appear in Railway Engineering and Maintenance from month to month? They are so detailed and accurate in their presentation of the facts. Above all, they show an understanding of the subjects under consideration that reflects long familiarity with the field. And they deal with timely subjects."

These comments from a long-time reader pleased us greatly for they showed that he had recognized and appreciated several cardinal principles in our set-up to serve you. They suggested the possibility that others of you might be interested in a "back stage" view of the way in which we go about the preparation of a story for you.

Take the article appearing in this issue describing the rail conservation practices of the Chesapeake & Ohio as an illustration. The first step in its preparation was a staff conference of our editors to select the topic or practice whose description would be most timely and helpful to you. Rail conservation met these requirements.

Then we looked for a road whose physical and traffic characteristics afforded a background for such practices and whose maintenance methods included the widest variety of measures contributing to this objective. Obviously, the road must be one of progressive leadership, if its practices were to be precedent-making. The C. & O. appeared to us to meet these requirements.

Having selected the subject and the road, we next approached the chief maintenance officer of this railway to ascertain whether we could secure from him and his staff the necessary co-operation in developing the facts. Receiving an affirmative reply (as we do almost invariably, because of the practically universal willingness of American railway officers to share experiences with one another), we assigned to this "story" a member of our own editorial staff because it has been our experience that these men, trained in your specific needs, are best able to meet those needs. Furthermore the editor so selected had had more than thirty years of practical experience in charge of track maintenance (in selecting our editors, our first requirement is several years of practical railway experience in maintenance of way work) and was thereby able to detect and to evaluate those measures which contributed to the study he was to make.

This editor went by appointment to Richmond, Va., the headquarters of the railroad, where he questioned the maintenance officers at length regarding their practices, the reasons therefor and the results obtained. He was given access to performance records and cost data. After two days of such study, he traveled over the main line from Richmond to Cincinnati, observing at first hand the practices that had been described to him and amplifying his notes. Carrying his camera, he also took numerous photographs of the practices he was to describe.

Returning to his office, he converted his notes and data into an article which, after review by the editor, was sent back to the railway for checking to insure that it was accurate in all respects. While the original copy of the manuscript was out for checking, the carbon copy was turned over to the "make up" editor to "lay out" in page form in order that the illustrations might be so located and their size determined to give the best appearance, preliminary to ordering cuts. Then when the manuscript was returned by the railway, we were prepared to send it, with the cuts, to the printer where the type was set and the pages made up in accordance with the "dummy" (layout). After proofs were read, corrected and ok'd, the editor's work was done and the article was ready for printing in the form in which you see it in this issue.

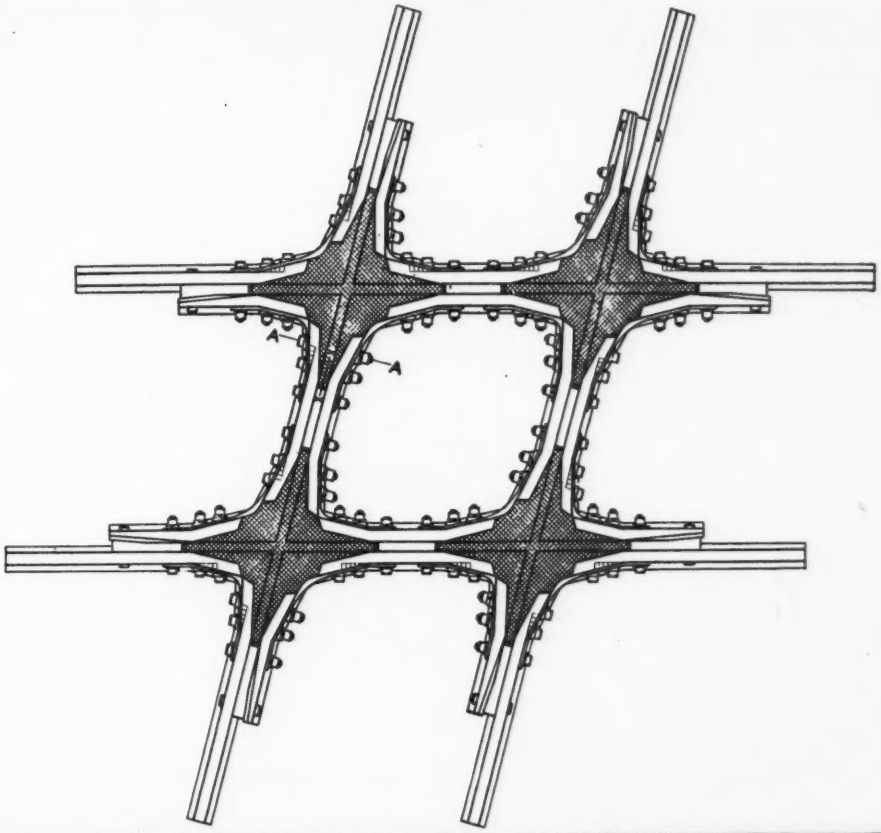
This is the procedure that we have evolved from experience as best adapted to bring to you information that will be most timely, accurate, interesting and, above all, helpful to you. We trust that you find the results worth while.

Yours sincerely,

Elmer T. Howson

ETH:OA. Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.



RACOR CROSSINGS *with* REVERSIBLE MANGANESE INSERTS

are economical because they last a long time, and the first cost compares favorably with other crossings designed for heavy traffic. The fact that the manganese inserts are reversible and interchangeable adds to their economy.

This crossing overcomes troubles caused by too great rigidity and provides long-wearing manganese surfaces where greatest pounding and wear occur.

Further savings are accomplished by the fact that worn castings can be reversed, thus utilizing the entire surface of the insert before scrapping. Many railroads stock one corner casting for each crossing as a spare to be applied to any corner as needed.

RACOR

RAMAPO AJAX CORPORATION

CANADIAN RAMAPO IRON WORKS, LIMITED

General Offices: 230 Park Avenue, N. Y.

Racor Works: Hillburn, New York • Niagara Falls, N. Y. • Chicago, Ill.
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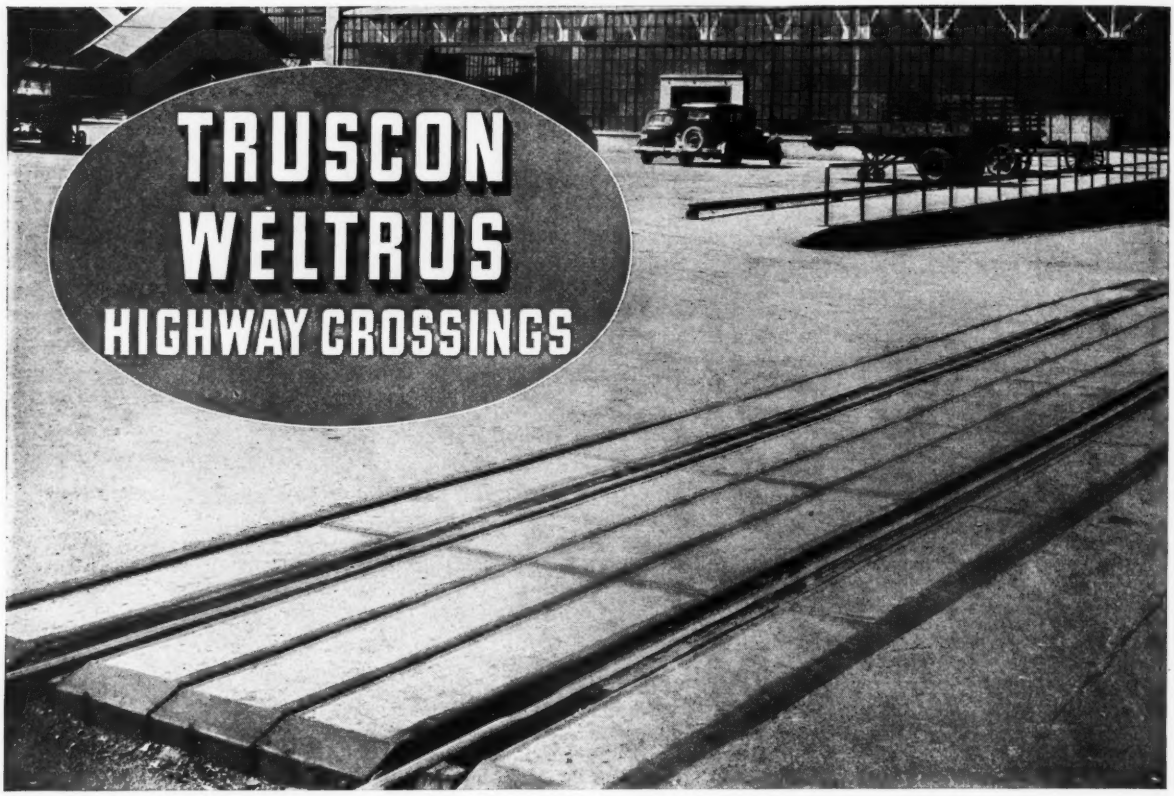

FULL UP TO HERE WITH ADVANTAGES

Brief and to the point is this familiar signal of brakemen. Brief and to the point is the following outline of Truscon WELTRUS Highway Crossings.

• They are designed for long life with no maintenance costs, thus spreading the installation cost over many years and making the annual cost negligible. • Made of copper bearing rolled steel channels, WELTRUS welded steel units, filled with concrete, provide double wearing surfaces. Actually, the concrete is *anchored into steel armor.* • WELTRUS Crossings are keyed between the rails which is the only rigid part of the right of way. The sections therefore are not affected by the movement of ties or roadbed. Easily removed for track repair work. • And because WELTRUS Highway Crossings improve public and employee relations, they are a credit to every railroad management. A FREE booklet explaining all details will be sent to you promptly upon request. Write today—no obligation.

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

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Railway Engineering and Maintenance

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September, 1937

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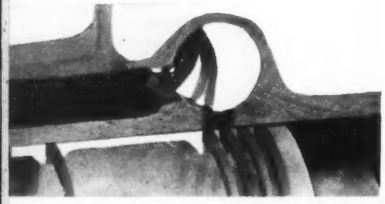
Performance ON THE JOB COUNTS

Fairmont M19 SERIES D

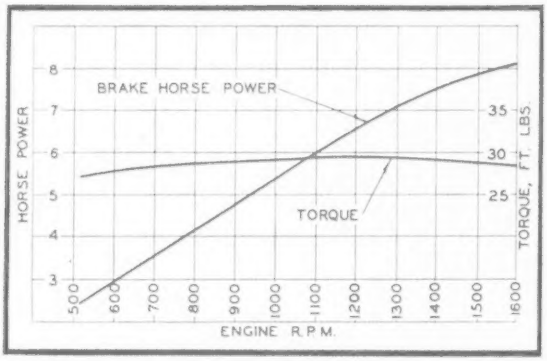
It's the lightest inspection car in its class! An Alco-Aluminum frame and Aluminum parts throughout reduce the rear lift of this Fairmont one-to-four man car to 96 pounds. Lift handles extend either front or rear.

The high torque 8 H.P. Fairmont engine and endless cord belt transmission handle without strain loads up to 750 pounds. Springs cushion riders against rail shock and "engine impulse" making every mile a comfortable mile.

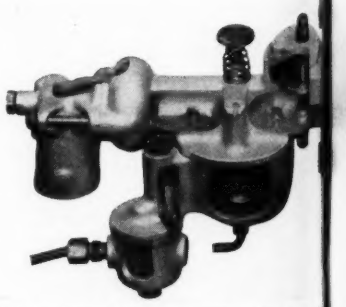
The superior performance and dependability of the M19 car have been proved by more than 15 years of continuous service on railroads everywhere. Fairmont Railway Motors, Inc., Fairmont, Minn.



The throttle valve permits fine adjustment for reduction of car speed to a walk for close track inspection. This view shows throttle closing all of intake except one-third of central port.



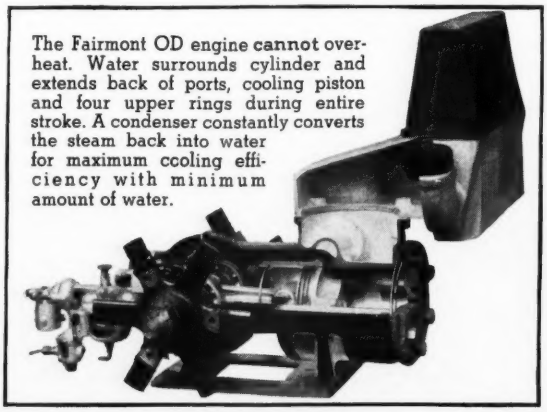
The high torque of the Fairmont OD 8 H.P. engine indicates good pull and real fuel economy at all speeds.

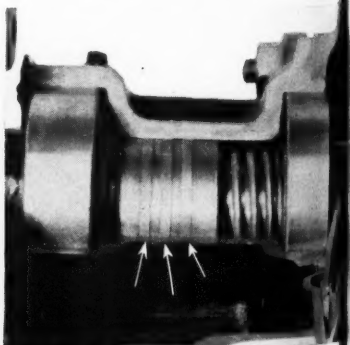


This modern aluminum carburetor insures easy starting and exceptionally smooth running in all kinds of weather.

Three ball bearings, instead of two, provide extra protection for crank arms and pin and assure longer life.

The Fairmont OD engine cannot overheat. Water surrounds cylinder and extends back of ports, cooling piston and four upper rings during entire stroke. A condenser constantly converts the steam back into water for maximum cooling efficiency with minimum amount of water.





"Ringseald" packing keeps Fairmont side bearings gas-tight and compression and engine power like new for years.

OF ALL THE CARS IN SERVICE TODAY

MORE THAN HALF ARE FAIRMONTS

Railway Engineering and Maintenance

Transportation

What agencies render the service?

AMERICA is a land of vast distances. Especially is this true in comparison with Europe. Because of this fact, transportation is of even more vital importance to us than to smaller and more densely populated countries. Our raw materials must be moved from remote forests, mines and farms to the industrial centers while our finished products must be transported from the mills and factories back to the consumer or to the sea coast for export, all at a cost which the consumer is able to pay. Because of the disparity in distances, transportation plays an unusually large part in our economic life and the value of an efficient system is correspondingly large.

Of late years much attention has been directed, and justifiably so, to the amounts of traffic that have been diverted from the railways to other forms of transportation, notably the bus and the truck on the highway, the barge on the waterways and the plane in the air, and the unfairness of these newer forms of competition has been emphasized. In the emphasis which has been placed on these competing agencies it is possible that the public, and railway employees as well, have gained an exaggerated idea of the extent of the transportation services rendered by these agencies in comparison with the railways. In other words, it is instructive to determine the extent to which these various modes of transportation are acting as the burden bearers of American industry.

Passenger traffic

Let us look first at passenger traffic for it affects the larger proportion of our people directly. The most recent data available here were compiled for the federal coordinator of transportation for the year 1933. These figures show that the airlines carried 0.3 per cent of all intercity and intracity (other than commutation) passengers carried by the three agencies of passenger transportation (railway, highway and air) and earned 3.3 per cent of total passenger revenues. Likewise highway operators carried 25.5 per cent of all passengers and earned 15.0 per cent of the revenues. The railways, on the other hand, carried 74.2 per cent of all passengers carried and earned 81.7 per cent of all revenues earned for the transportation of passengers. Thus, in spite of the inroads which these other agencies have made, the railways were still the means to which nearly three quarters of all our people turned when traveling. Furthermore, with the widespread improvement which the railways have made in their passenger service and the marked increase in railway travel that has occurred since 1933, it is evident that the proportion of the total business carried by the railways has increased especially at the expense of their competitors on the highways.

Freight Service

In the transportation of the nation's products, the division is equally interesting. In another study made for the federal coordinator of transportation, analyzing the nation's traffic movement for 1932, it was shown that 7 per cent of the tonnage was moved by pipe lines, 17 per cent on the waterways (inland and Great Lakes) and 32 per cent on the highways (including local traffic) while 44 per cent of the tonnage was moved by the railways.

However, the true measure of transportation service is indicated by ton miles rather than tons, because of the varying distances which traffic is handled by these different agencies. On this basis, 5 per cent of the transportation of commodities is provided by the pipe lines, 2 per cent by the inland waterways and 14 per cent on the Great Lakes, while, because of the markedly shorter haul, less than 10 per cent of the ton mileage is produced by highway carriers, as compared with more than 69 per cent by the railways.

In other words, in spite of all of the traffic that has been diverted from the railways to these newer agencies of transportation, nearly three quarters of all of the freight service and more than three quarters of the passenger service is still rendered by the railways. Furthermore, with the faster and better services that the railways are now offering for both freight and passengers and with the increasing restrictions that government is placing on the competitors of the railways, notably on highways, it is to be expected that the return of traffic to the railways, which began a couple of years ago, will be accelerated during the next few years.

These figures and trends are important to those interested in the transportation service of our country as a means of demonstrating the relative value of these agencies and the proportions of the nation's burdens that are borne by each, in order that the inroads on the traffic of the railways, serious though they are, may not be overestimated and the magnitude of the service rendered by the railways correspondingly underestimated.

Clean It Up

Impression on Patrons to Be Considered

THE output and efficiency of gangs employed in rail renewal or ballasting are appreciably reduced in territories where there are numerous turnouts, crossovers, highway crossings and the like. And the larger the gang, the greater the difficulty in keeping all the men productively employed during the time that the routine operations are disturbed by special conditions—for example, the renewal of several turnouts. For this reason two expedients are commonly adopted in such locations, (1) the use of small gangs and (2) the completion of the out-of-face work first, to be followed later by piecemeal cleaning up in the locations imposing the greatest complications.

This is undoubtedly the most practical solution, but there is the danger that this procedure will result in having the work in a state of partial completion over too large a territory at one time. In a ballasting operation recently observed, stretches of track a half mile or more in length were allowed to remain in a skeletonized condition for more than a week and the track at a heavily-patronized station was not dressed for more than two weeks after the dressing ballast had been unloaded. In fairness to the men in charge, it must be said that the location is one presenting many obstacles to an out-of-face procedure and heavy traffic precluded the "killing" of any track for more than a few hours a day. Nevertheless, the manner in which the work was conducted created a decidedly unfavorable impression.

Improvements

Much Work Now in Progress

ONE railroad is now preparing plans for the reconstruction, replacement or overhauling of some 50 water stations. It is also engaged in the improvement and modernization of a large number of passenger stations. Another road is constructing additional stalls at three engine houses, in addition to a complete new engine terminal, and has work in progress on four new coaling stations, several cinder pits and three power plants. These are indicative of the character of improvement work that is in progress on many railways—of modest proportions when considered individually, but large in the aggregate.

Thus we find an effective answer to the contention, so often advanced during the depression, that there would be scant need for additions to or betterments of fixed properties for many years to come, because facilities that met the needs of the heavy traffic of 1929 would be adequate until the volume of traffic approached or equalled the level reached in pre-depression days.

The flaw in this argument is that the requirements for the effective conduct of railway transportation do not remain static, even if the volume of traffic is not increasing. For example, the amount of wheat moved into Kansas City, Mo., during July was greater than in any previous month in history, although freight traffic for the railroads as a whole was by no means at a maximum. Changes in operating methods, new equipment, faster schedules, air conditioning and other new developments give rise to the need for new or remodeled buildings and terminal facilities. They also demand the reconditioning of structures that suffered neglect during the trying days of the "early thirties." The railroads have such an enormous investment in fixed properties that it is seldom economically possible to make replacements or even pronounced changes as fast as the need for them becomes apparent. However, the start has been made and the work will go on.

Machinery

Selecting Men for Its Operation

THE problem of selecting men for track maintenance has become much more complex since power tools were introduced. In earlier days the prime requisite was a rugged physique, capable of withstanding the arduous manual labor involved. Foremen were selected by picking from the men in the gangs, those who possessed the elements of character and leadership necessary to fit them for the responsibility of directing the work of others. And so far as the laborers and foremen are concerned the requirements remain the same as in the past, but in addition to these the employing officer is today faced with the recruiting of men for the operation of power machines.

As the use of machinery has grown, maintenance officers have recognized a distinction between the requirements of a man who merely operates a power tool and one who provides the attendance for a power plant or a more or less complex machine. For example, the operation of a power tamping tool or spike driver calls for little more than physical strength, whereas, the care of a gas-engine-operated air compressor demands considerably more than mere physical soundness or an ability to acquire dexterity in certain elemental operations.

There is no lack of young men who are qualified for training as power machine operators and attendants, and who with experience would become competent maintainers. A natural bent for machinery is soon manifest in a boy, and if he does not enjoy the benefits of a high school manual training course he will find an outlet for this flair for things mechanical by operating and overhauling decrepit automobiles, farm tractors, and the like. Young fellows of this type are not only quick to "catch on" and naturally skillful in the use of tools, but are never happier than when they are working on mechanical appliances.

The real problem before maintenance officers is to find these young men and attract them into the service. True, there are pitfalls in the way and formidable obstacles to overcome, but if opportunities are afforded for them to obtain reasonably steady employment in jobs that have to do with machines there should be no difficulty in getting them into the service. The important point is to recognize the need for young men of a particular make-up.

Keeping Up

Roadmasters' Meeting Offers Fine Opportunities

WITHIN recent years the work of the roadmaster has become more exacting than ever before and, judging from the present trend of developments in the railroad field, it is likely to become even more so as time passes. The last two decades have seen a complete revolution in track maintenance methods, characterized mainly by the widespread introduction of mechanized equipment and the application of mass-production methods to many maintenance tasks. To keep abreast of these rapid changes has required a real struggle on the part of roadmasters and other maintenance officers, many of whom, as an aid in adjusting themselves to the new state of affairs, have sought the benefits to be derived from participation in the activities of the Roadmasters and Maintenance of Way Association.

They have found that the annual convention of this association, coming as it does as the more active working season is drawing to a close, comprises an ideal occasion for the exchange of experiences with new methods and practices, and that more complete information concerning new developments in maintenance of way materials and equipment can be obtained by an examination of the exhibits which are presented annually in connection with the convention by the members of the Track Supply Association than can be secured in any other way. Thus, for many years the Roadmasters Association has played an important role in the life of the progressive roadmaster; yet in view of the present trend of railroad affairs, maintenance officers will rely even more heavily on their association in the future than they have heretofore.

This is true because the best interests of the railroad industry can be served only by co-operative effort on the part of the roadmasters in the solution of the intensified problems with which they are now, or soon will be, confronted. For several years the railroads, in order to satisfy the demands of the shipping and traveling public, have found it necessary progressively to increase the speed of trains. With greater demands thus being imposed on the track structure, the necessity of a higher standard of track maintenance has naturally kept pace with the trend of train speeds. This state of affairs, of course, has added to the load being carried by the track department, but with business increasing and net earnings keeping pace with the improvement in business, it was generally felt that the necessary additional funds required to maintain the tracks to the higher standard, employing present practices without substantial change, would be forthcoming.

Subsequent developments have proved the fallacy of this reasoning. While carloadings have continued to show a fair gain, expenses, because of higher costs of fuel and supplies, increased wages to employees and other costs beyond the control of the carriers, have shown alarming increases. Moreover, pending developments, if they materialize, will add further to the already inflated expenses of the carriers. As a result the railroads are now confronted with a declining trend in their net income instead of the increase which was expected.

This situation contains serious implications for the maintenance departments. While charged with the responsibility of maintaining the tracks to higher standards than ever before, they are confronted with the possibility that it may be necessary to do this without the increase in allotments which they had hoped for.

With this situation confronting them it is obvious that maintenance men must rely to a greater extent than ever before on mechanized equipment as a means of accomplishing maintenance tasks with a minimum outlay. But what new equipment is available? How can it be used to reduce unit maintenance costs? What improved and more economical practices have been introduced on other roads? No better start toward obtaining a satisfactory answer to these questions can be made than by attending the fifty-second convention of the Roadmasters Association, which will be held at the Hotel Stevens, Chicago, on September 14, 15 and 16.

Welding

No Substitute for Skilled Workman

NO PHASE of track maintenance has undergone a more marked change during the last twenty years than the maintenance of frogs and crossings. As a matter of fact, it could almost be said that, except for the tightening or replacment of bolts, frogs and crossings were subjected to little real maintenance two decades ago. About all that could be done with them when they were worn beyond allowable limits was to take them out of track for rebuilding or scrapping. Fusion welding has changed this picture—special trackwork is now retained in track for service periods undreamed of a few years ago.

However, in the light of what is now known about the requirements of good workmanship in welding, or of the difference between the results to be expected from correct and incorrect methods of doing the work, it is easy to understand why many of the early efforts to apply fusion welding in this field were attended by indifferent success and frequent failures. The reason is obvious; this work represented the pioneer application of a new process with untried materials and unskilled workmen. Increased metallurgical knowledge, improvement in the quality of welding rods and the knowledge gained by the process of trial and error have been responsible for the creation of a technic in the repair of trackwork by welding that will assure good work, if rigidly observed.

This technique embraces discrimination in the selection of materials, the application of rather well-defined rules of procedure, and criteria governing the decision as to whether a given piece of repair work should or should not be undertaken. But even more important than any of these, it calls for welding skill. Unlike blacksmithing, in which knowledge and skill have been passed from master to apprentice since time immemorial, fusion welding has been evolved in a few years by the joint application of theory and practice, but the fact still remains that there is no substitute for the skill of the craftsman.

The Continuous Welded Rail Is Being Laid in Both Stone- and Cinder-Ballasted Track

30 More Miles of Welded Track

DURING the present year the Delaware & Hudson is extending by a large mileage its continuous welded track, and, of equal interest, it is now employing in part a type of rail weld new in this country, called the electric flash butt weld, which is being made with new equipment developed and operated by Sperry Rail Service. Altogether, the road is welding a total of 316,800 ft., or 60 miles, of rail in its 1937 program, which will involve a total of approximately 7,200 electric flash welds and approximately 1,200 Thermit pressure welds.

In the work being done, standard 131-lb. 39-ft, rails are being welded into continuous lengths of 780 ft. or more on strings of flat or open-end gondola cars for movement to the points of laying. At the desired points, these long rails are pulled from the cars one at a time and are subsequently joined into continuous lengths, except where insulation is required, by means of Thermit pressure welds.

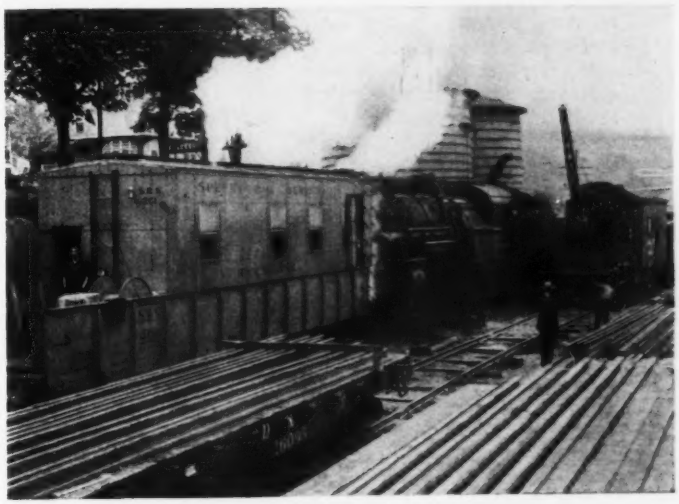
The Delaware & Hudson began the laying of long welded rails in 1933. In that year it made an installation in its main line tracks at Albany, N. Y., which involved a total of 12,075 lin. ft. of rail and 316 Thermit pressure-welded joints. This installation, which included rail lengths up to 2,700 ft., was followed in 1934 by an installation of long welded rails at Mechanicsville, N. Y., involving 10,171 lin. ft. of rail and 254 Thermit joints. Both of these installations were described in detail in *Railway Engineering & Maintenance* for January, 1935.

In 1935, continuing its experiment, the road made welded rail installations at Schenectady and at Windsor, N. Y., involving a total of 42,861 lin. ft. of rail and 902 welded joints. During that year practically all of the joint welds continued to be made by the Thermit process, although the program included a total of 70 experimental electric flash welds, a type of weld then new in this country for rail work, but already used to a considerable extent by several European roads. These 70 electric welds were made in the plant of the General Electric Company at Schenectady, and the sections of joined rails, which, because of insufficient space within the plant were limited to two or three rail lengths, were laid in the track and joined into continuous lengths with other rails by means of Thermit pressure welds.

During 1936, while the development of flash-welding equipment in this country was continued, the road installed an additional 10,079 ft. of Thermit welded rail, bringing the total amount of welded rail in its tracks by the end of 1936 to approximately 16 lineal miles,, with 1,955 welded joints. All of the rail involved in this work was new, of 131-lb. section, and was laid in stone-ballasted track employing new tie plates and M. & L. type rail fastenings.

In 1935, Sperry Rail Service became interested in the electric flash welding of rails and took over in large part the development of portable

During the present year, the Delaware & Hudson is extending its continuous welded track 30 miles, employing electric flash butt welds and Thermit pressure welds to join the rails into lengths of 780 ft. or more on cars for movement to the points of laying, and Thermit pressure welds for effecting closures between these lengths in the track. The manner in which this work is being done, and the newly developed equipment employed in the flash welding, are described in this article.



equipment which could be moved from one location to another on a road, or from road to road as desired, to carry out rail welding work. Later, as the development of its equipment progressed, it contracted with the D. & H. to do most of the joint welding in its 60-mile rail program for 1937. This program was begun at Schenectady in May. Later, the equipment was moved to Port Henry, N. Y., and subsequently to Oneonta, N. Y., and then to Albany, N. Y., completing welding at each of these points. All of the electric flash welding which has been done has included the heat-treatment of the rail ends to relieve any abnormal stresses within the rail as a result of the welding, and the necessary grinding to produce the best joint conditions.

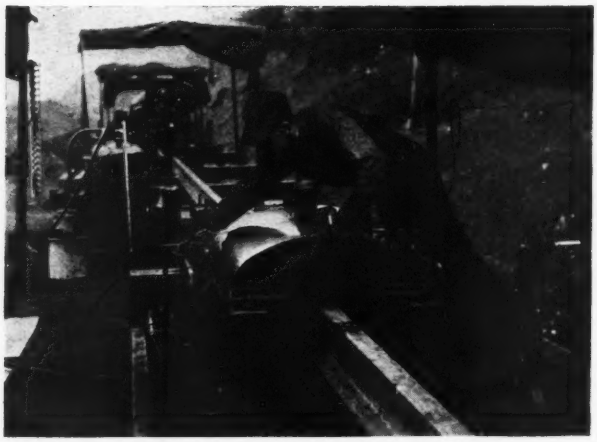
Equipment Described

The equipment employed in the flash welding on the D. & H. involves essentially a welding car, housing a specially-constructed flash welding machine; a generator car, housing two turbo-generators for supplying current for the flash welding operations; a steam locomotive for supplying steam to the turbo-generators; a rail-rack car for lining up and otherwise preparing the rails for movement to the welding machine; a series of five flat cars on which the stress-relieving equipment and joint grinders are located; and the requisite number of flat or open-end gondola cars for holding the long rails for subsequent movement out on the line.

As arranged for operation, the dif-

Top—Looking Along the Flash Welding Train, Showing From Right to Left the Welding Car, the Stress-Relieving and Grinding Cars, and the Rail Storage Cars. Above—The Generator Car, Steam Locomotive and Rail Crane Employed in the Flash Welding Work

Right—Within the Welding Car During the Flashing Operation



The Stress-Relieving Treatment Materially Improves the Character of the Flash Welds

ferent units of equipment are set up in the following order; the steam locomotive, the generator car, the rail-rack car, the welding car, the stress-relieving unit car, four grinder cars, and then the series of rail storage cars. This set-up of equipment requires the use of two long yard storage tracks, the length of the tracks depending upon the length of continuous rails to be produced. On the D. & H., the lengths being produced in the 1937 program have been confined usually to 780 ft. (20 rails) because of limited yard-track capacity. In the two-track arrangement for the welding work, one track is used by the welding, generating, grinding and storage cars, while the other track is used primarily as a supply track for servicing the welding operations.

Welding Equipment

The flash welding car, which is a steel-underframe, wood-enclosed boxcar, houses essentially the flash welding machine, a hydraulic pump, electrical control equipment, and roller conveyors for the movement of the rails to and from the point of welding. The flash welding machine is essentially a two-part unit on a structural steel bed, one part of which is rigidly fixed, while the other is a movable platten which supports the end of the rail that is to be welded to the long string of rails. Both the fixed and movable sections of the machine are equipped with hydraulic clamps for holding securely the rails to be joined, and with electrical contact clamps which pass the welding current into the rails.

The generator car is a specially-constructed steel boxcar, which houses the two steam turbo-generators, one of which supplies current to the welding machine and for the operation of a haulage winch, which will be mentioned later, while the other supplies current for lighting, for the operation of the hydraulic pump of the rail clamping mechanism, and for the operation of all auxiliary motor units forming a part of the welding outfit. Steam for the operation of the turbine driving the generators is, as before mentioned, furnished by a regular road type of locomotive located immediately ahead of the generator car. The steam demand of the turbine ranges from 15,000 to 22,000 lb. per hr., with pressure at the turbine nozzles varying between 175 and 200 lb. per sq. in. The only fundamental requirement in connection with the locomotive, other than its steaming capacity, is that it be equipped with an outside six-inch steam line from its steam dome to its front end, where connection can be made with the steam line of the generator car leading to the turbine.

The rail-rack car is a flatcar which is equipped along one side with an inclined rail rack capable of holding nine rails. This rack feeds on to a line of rollers through the center of the car, over which the rails are moved forward, one at a time, into position for welding in the welding car. The rails are loaded on the rack car by means of a crane, and the only work done on them prior to the welding operation is a small amount of grinding on the head and base at each end to insure efficient electrical contact in the welding machine, and the removal from their end faces of any rust which might be present. This work is done on the rack car by two men with air-driven grinders.

There Are Four Separate Grinding Operations on the Flash Welds as They Come from the Welding Car

Making the Welds

The actual flash welding of the rails involves three steps, all of which are controlled by a single operator. These three steps are pre-heating of the rail ends to be joined, flashing, and a push-up. Arranged for welding, the rails are gripped simultaneously by the clamping dies and by the current contact pads in the two parts of the welding machine. In the pre-heating operation, the single rail, fixed to the movable platten, is brought up to intermittent short circuiting contact with the end of the fixed rail, which in a short time raises the temperature of the rail metal at the ends to practically a fusing heat. When this stage has been reached, the flashing operation is carried out, which involves continuous short circuiting of the welding current by bringing the rail ends into continuous contact. In this operation, the steel immediately at the rail ends changes to a molten stage and flashes out from the contact faces, removing any rough spots or oxidized metal on the rail ends. It is from this flashing action that the process derives its name.

Following a predetermined amount of flashing, the rail ends are brought together under hydraulic pressure, causing the molten metal at the ends to fuse together and producing an upset area around the periphery of the rail at the point of weld. Immediately following the push-up operation, the rail clamp on the movable platten of the machine is released from the rail, and, under hydraulic pressure, the platten is moved forward to a

point where it shears off the upset metal on the underside of the rail base. This procedure removes the undesirable push-up metal and produces a level bearing for the rail at each joint.

Stress Relieving, Grinding

Simultaneously with the making of each flash weld, certain completion operations are carried out on the welds previously completed on the flatcars immediately beyond the welding car. These operations, which proceed five joints at a time, complete the conditioning of the welds for service in the track. The first of these is a process of stress-relieving at the welds, while all of the following operations involve the grinding away of the undesirable portions of upset metal.

The stress-relieving operation, which is required because of the high concentration of heat directly at the rail ends in the flash welding process, is carried out in an oil-fired heating oven, or furnace, wherein the rail immediately at and for a distance each way from the weld is brought to a pre-determined temperature, and then allowed to cool under atmospheric conditions. The temperature involved in the stress-relieving operation is controlled accurately by means of a recording pyrometer, and was arrived at after a series of tests conducted to produce a weld with the greatest endurance.

The first grinding operation on the welds following the stress-relieving operation involves the grinding away of the upset metal from the two side faces of the rail head. This is done by a machine-mounted pair of grinding wheels located over the position of the weld, which grind to gage the metal on one side and then on the other.

The second stage of the grinding, proceeding simultaneously with the first stage, involves removing the upset material from the underside of the rail head on both sides, through the fillet area, and from the top of the base flanges, and also a certain amount of rough-grinding of the rail head. The removal of the upset metal from the fillet areas and from the top of the base flanges, is done with a flexible-shaft rotary grinder to minimize the possibility of a fatigue failure starting in any of these areas of the weld, which are alternately in compression and tension.

The third grinding operation, carried out at the joint immediately ahead, simultaneously with the first and second operations, involves the intermediate grinding of the upset metal over the top of the rail head. This is done with a hand-controlled, roller-carriage-mounted cup-wheel type grinder, which is rotated as necessary to produce the approximate contour of the rail head through the weld area. The final grinding operation, which is done at the same time as the grinding operations already described, involves the smoothing-up of the rail head through the weld area, and is done with a reciprocating-grinder.

In the more or less "straight-line" method of producing the flash-welded joints, all movements of the rail are made by power devices. As already mentioned, the individual rail lengths to be welded into strings are brought into position in the welding machine over a series of motor-operated rollers. The strings of rails are moved from the welding machine as they are extended by each new weld, by means of a cable and an electrically-operated haulage which located on a flat car which is arranged at the far end of the rail storage cars.

Various types of rail supports have been used on the grinding and storage cars, but it is now the practice to use T-beams, with rollers in the center, on all of the grinding cars, and short lengths of scrap rail on the storage cars, there usually being three of these to the car length. During the early work of storing the long rails on cars for subsequent movement out on the line, as few as 2 rails were handled at a time. In later operations, 7 or 8 long rails were handled at a time, and as many as 12 strings of rails have been lined up on cars and taken out on the line without experiencing any difficulty.

The force involved in the flash-welding work includes 6 men in the employ of the Sperry Company and 10 to 12 men in the employ of the railroad. The production of the flash welding outfit during the early stages of the work varied widely, and, because of developments and changes in the design or arrangement of equipment, was far from what was anticipated. However, with the progress of the work, production has increased steadily to the point where, in recent weeks, from 100 to as many as 166 joints have been completed in a working day involving two eight-hour shifts as the working period.

Unloading Rails

All of the welded lengths of rail, after being unloaded at the site of laying, are equipped on the ground with new tie plates and either M. & L. or compression-type spring clips, and are subsequently lined over into position in the track and temporarily joined together with standard four-hole rail joint bars, employing bolts in only the end holes. Later, all of these mechanical joints are removed in turn and the long lengths of welded rail are joined together by Thermit pressure welds, bringing about continuous rails up to a mile or more in length between insulated joints.

The Rail Unloads Itself as the Train Is Pulled Out from Beneath It

Future Procedure

In the ultimate arrangement for making the closure welds between the long sections of welded rail, it is planned to make these welds by the Thermit process while the rails lie alongside the operating track, and then to line the rails into position in the track between trains. This latter method, which is considered the more effective and economical, and which can be done with much less interference by or with train operation, has been carried out to some extent in the work which has been done to the present time, and has not been used more extensively only because of the pressure of other work on the track forces, which has made it difficult to

bring together the proper size force for carrying out the closure welding in advance of the program for getting the new rail into the track.

The unloading of the long rails is accomplished by pulling them off from the rear of the train and laying them down immediately outside of the running rails on the track shoulder. The lengths are then barred on to the tie ends, as necessary, workwise, ready for the application of the new tie plates and for lining into position in the track. With careful spotting of the rails, they are unloaded end to end, ready for joining in the track. If there is an overlap or gap at the ends, the rail, depending upon the amount of overlap or gap, is butted to proper location or adjusted by means of a chain hitch from a work train. During the rail renewal operations, the two outside bolt holes are drilled in the rails and the bars are applied, forming the temporary connection until the Thermit closure weld can be made.

All of the Closure Welds Are Made by the Thermit Process

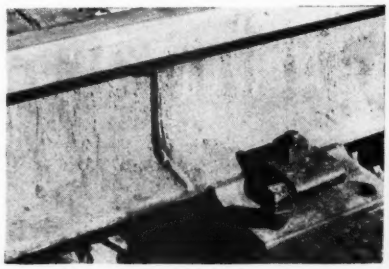
Closure Welds

Making the Thermit closure welds in track involves much the same procedure as making standard Thermit pressure rail joint welds, except that an insert section of metal is used between the facing rail heads and the upper parts of the webs. This insert brings about in part the pressure necessary between the rail heads for producing an effective pressure weld, and, at the same time, provides an opening between the adjacent rail bases and lower sections of the web for producing the Thermit part of the weld.

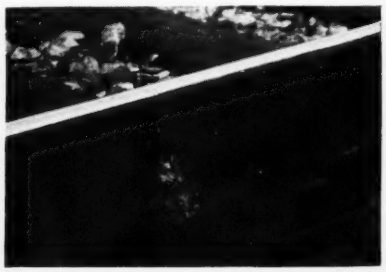
In more detail, in making the closure welds in track, the spring rail fastenings are first released for a distance of approximately 50 ft. each side of the joint to be welded, and then, one at a time, the rail ends are faced with a grinding machine. In the next operation, employing the powerful clamp used in the Thermit pressure welding process, the rail ends are forced apart until there is an appreciable space between them. This space can be from ⅛ in. up to 1¼ in., as inserts of varying thickness within this range are available, but in the neighborhood of ½ in. is considered the most satisfactory opening, involving the least work. Where the space is less than ½ in. the lower portion of the webs and bases of the rails must be burned back with an acetyiene torch to provide a gap of at least ½ in. for the Thermit weld.

After the rail ends have been forced apart and the proper size insert has been driven in place, the Thermit weld is made in the usual manner, involving the placing of molds about the rail ends, pre-heating the rail ends, pouring the Thermit metal about the ends, drawing up the clamp to produce the pressure weld in the head area, removal of the molds, and the dressing-up of the weld by grinding or otherwise. These various operations as a whole require approximately three hours time, which means that the closure welds must be made during periods of light traffic, or that traffic must be detoured around the work.

Most of the closure welding in track on the D. & H. has been carried out between trains, and, to permit of the greatest progress, a number of welds have been completed at the same time by independent Thermit welding gangs. As a result, as many as five or six closure welds have been made at one time in intervals between traffic movements.



An Electric Flash Butt Weld In Track



A Thermit Pressure Closure Weld In Track

Where the closure welds are made before the rail is lined into the track, the welding operations are fundamentally the same as those involved when the rail is in the track, using the insert method, the primary requisite being the proper facing and spacing of the rail ends, and the provision of enough compression in the rails to permit of 5/32-in. to 3/16-in. pull-up in effecting the pressure weld in the head area.

If the welded rails have been unloaded carefully, a minimum of adjustment is usually necessary to bring the facing ends into proper position for welding. If there is an overlap at the ends and it is not deemed advisable to attempt to adjust the rails longitudinally to the proper position for welding, one of the rail ends can be burned off by an acetylene torch to the proper length.

If there is an appreciable gap between rail ends, and if for any reason it is not desirable to adjust the rails longitudinally to the proper position, a short length of rail can be welded into the gap, making two Thermit welds. If this latter procedure is adopted, however, it is deemed advisable to make the closure section of rail at least 9 or 10 ft. long, burning off a section of one of the long lengths, if necessary, to provide a gap of this size. Where this procedure is resorted to, which is recommended only where it would be particularly difficult to adjust the long rails to proper position because of the increased expense involved, the first of the welds is made by the usual Thermit pressure weld process without an insert, while the second weld is made as a closure weld with an insert, as already described. Following rough dressing-up of the welds, the long rail lengths are then lined into the track in rail renewal operations, and the final grinding of the head area is done with a reciprocating-type grinder.

Combined with the spring clip or compression type of rail fastening employed on the D. & H., with double-shoulder tie plates, the road, through its welded track construction, has

(Continued on page 612)

Comparative Economy in Crosstie Renewals*

By A. H. Peterson

Roadmaster, Chicago, Milwaukee, St. Paul & Pacific, Chicago

BEFORE one is in position to discuss intelligently the comparative economy of using section or extra gangs for tie renewals he must know how many ties are to be renewed per mile, the number of miles involved, and something of track conditions. Obviously, there can be no economy in walking a gang of 50 to 100 men over a mile of track in which only 40 or 50 ties require renewal for so much time will be spent in walking that it will be cheaper to permit the section forces to make the renewals. Experience has shown, however, that where the renewals run as heavy as 200 or more to the mile, they can be made at lower cost by extra gangs than by section gangs.

All of the arguments which are used to favor mass production are on the side of the extra gang. A large gang can utilize power equipment to expedite the various operations. Where raising is done in conjunction with the tie renewals, power jacks can be used for making the raise and power tampers for tamping the ties. The ties can be unloaded with work trains, cranes or motor cars which are engaged solely in tie distribution.

By the very nature of their work men on section gangs must be jacks of all trades and even when putting in ties a section laborer must use a variety of tools, some of which he may not be able to use skillfully. Oftentimes, he must handle a shovel, a claw bar, tie tongs, a spike maul, a track jack, a pick and a lining bar, all in connection with the insertion of a single tie. Quite naturally, he loses considerable time in picking up one tool and a moment later exchanging it for another.

In an extra gang which is of the right size to permit the development of a well-balanced organization, every man uses only a single tool and uses it steadily throughout the day. The spikers are chosen because of their ability to do a good job of spiking, and this selected group does nothing but spike. The men engaged in this phase of the work become specially skilled as time goes on. Likewise, the more capable diggers are assigned to shovel work, and so on through the entire range of operations which must be performed in connection with tie renewals.

On a section gang, in which only a few men are employed, each one must be prepared to handle at a moment's notice any one of the tools assigned to the gang. A good shovel man may be an extremely poor spiker, but despite this he must handle a spike maul when there is spiking to be done.

Section gangs have a wide variety of work to do. They are responsible for the current maintenance and the safety of their track. The renewal of ties is only one of the many tasks they must perform. Because of the variety of work with which they are burdened, they are seldom able to do without constant interruption any job which must be extended over a considerable period. Serious loss of time often results from this necessity for changing from job to job, usually at short intervals.

On the other hand, since an extra gang does only the class of work to which it is assigned specifically, it can keep at it steadily and without interruption until it is completed. A large extra gang moves rapidly over the stretch of track upon which it is working, thus effecting its quick release and reducing delays to trains.

In multiple-track territory it is often possible to divert traffic for large gangs during the working hours without serious interference with train movements, but a small section force requires so much longer to cover the same amount of territory that traffic diversion becomes impracticable, especially in view of the number of sections which may be involved. On a branch line of light traffic the interference from trains may be negligible, but on heavy-traffic lines a section gang may spend up to 50 per cent of its time keeping out of the way of trains.

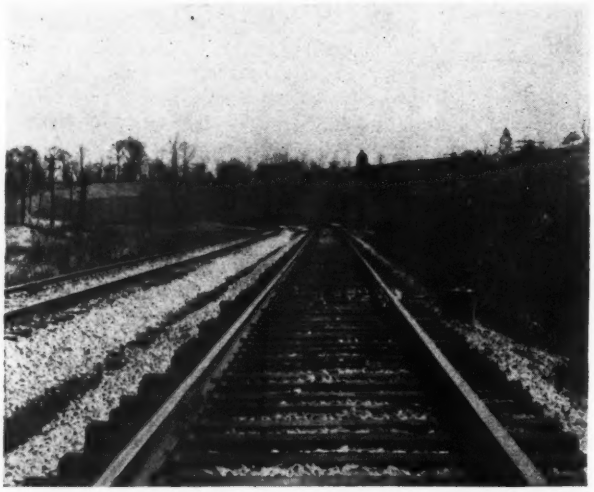
Objection is sometimes raised to the use of extra gangs on the ground that they do poor work, slight certain parts of the work which should be given attention and are prone to waste material. The responsibility for the quality of the work turned out by any gang and for the economy of its performance rests upon the division officer in charge of the work. If quality is insisted on, it will be obtained from an extra gang as well as from section gangs. It should be remembered that the tie inspection upon which renewals are based has been made by the section foreman, and has been checked by the roadmaster and the division engineer.

Another fact that demands consideration is that on some roads the rate for extra-gang labor is less than for section labor. For this reason, if only the same output per man-hour is obtained, the unit cost of tie renewals will be less when made by the extra gang. Furthermore, it has been shown that where the renewals reach or exceed 200 ties to the mile the man-hour output of the extra gang is greater than that of the section gang.

It is a maxim of long standing that the proof of the pudding is in the eating of it. Experience on one road which renewed more than 1,000,000 crossties with extra gangs during 1936, has shown that the labor cost per tie was less than $0.18.

*This discussion was submitted for publication in the What's the Answer department in the April issue as an answer to the question whether tie renewals can be made more economically by section gangs or by extra gangs. Owing to its scope it was withheld for presentation here as an independent article. For further discussion of this subject see page 290 of the April issue.

One of 12 Grade Crossings on the Niagara Junction Railway That Are Illuminated with General Electric Luminaries

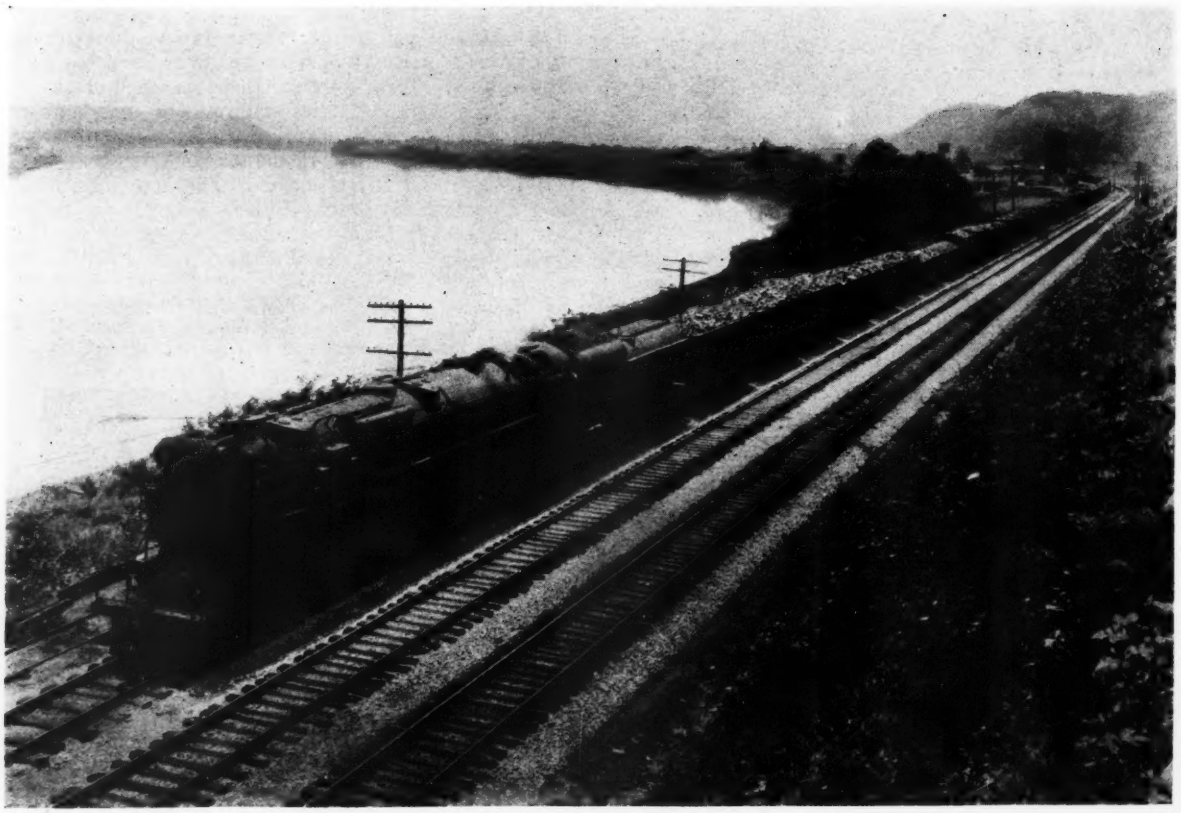


Some 500 Rail and Flange Lubricators Reduce Rail Wear

Getting

That rail conservation has an important place in the maintenance program of the Chesapeake & Ohio is indicated by the fact that a large annual saving is being realized through a wide variety of practices directed toward extending the life of rail on this road. This article describes some of the measures that are being taken to conserve rail and shows how research is being coupled with practice to produce this saving, as well as to improve track conditions.

Traffic Density on Main Lines of the Chesapeake & Ohio Is Exceedingly High



the Most from Rail

on the Chesapeake & Ohio

OWING to its location, traversing as it does the coal-producing sections of West Virginia, Ohio, and Eastern Kentucky, traffic density is high on both the primary and many of the secondary lines of the Chesapeake & Ohio. Consequently, for many years it has been necessary to maintain a high standard of track structure. To maintain the required standard under this traffic, it was necessary to renew much of the rail at relatively short intervals, for, although the weights of cars and locomotives were less than today, the rail sections of 15 to 20 years ago were also lighter, and the rail wore out within a discouragingly short time. For these reasons, means to extend the life of the rail became a matter of importance on the grounds of both economy and track conditions.

Through a progressive policy of conservation, the Chesapeake & Ohio has been able to increase the life of its rail, despite a high and constantly increasing density of traffic. The methods adopted include a variety of practices which have become standard because they proved to be effective. The practices which are now considered standard are carried out as part of the regular maintenance program and are so co-ordinated as to fit in with other maintenance requirements. The results obtained demonstrate the merits of following a continuous system of research to evaluate the economic advantage of the practices which are being followed, as well as to determine whether other or proposed practices are worthy of consideration.

Methods Are Examined

One of the interesting features in connection with the methods that are being employed on the Chesapeake & Ohio is the open-mindedness of the maintenance of way officers with respect to the methods themselves, and of their approach to suggestions for improvements or for the substitution of others for which greater advantages are claimed. This should not be taken to mean that they accept these suggestions at their face value, for an outstanding characteristic of the entire maintenance organization is the thoroughness with which such proposals are examined before they are applied generally, or are rejected. As a result of this attitude, a large number of tests are being conducted to determine whether claims are warranted and if so, how the advantages from the standpoint of both economy and improvement in track conditions compare with current practices.

While the desirability of increasing rail life was apparent years ago, efforts to accomplish this were confined principally to increasing the size of the rail section. In 1923, however, the Chesapeake & Ohio rebuilt a number of rail ends by the process of welding, which art was still in the experimental stage. The results were satisfactory, and the process was extended gradually so that by 1929 it had become a major maintenance operation, an average of 129,000 joints a year being built up over the system. This volume of work was continued annually until the amount of new rail replacements, together with other improved methods of rail maintenance, permitted a reduction in the welding programs.

It is of interest to note that while all welding is included and governed by the system maintenance program for the purpose of co-ordinating it with other maintenance activities, where the welding is performed by the oxy-acetylene method, the work is handled by division gangs reporting to the respective division engineers, with results subject to the supervision and inspection of system officers. All electric-arc welding performed by company forces is handled by system gangs reporting to the supervisor of reclamation. Experience has impressed the officers with the importance of effective joint maintenance in conjunction with welding if best results in extended life of rail are to be obtained. As a consequence the welding gangs are scheduled to follow closely behind ballasting or out-of-face surfacing gangs. Where spot-surfacing only is necessary, the welders are preceded by the section forces, who also cooperate with the welders to the extent of replacing worn angle bars and tightening track bolts.

Welding Is Out-of-Face

All joints on any stretch of track do not have the same amount of batter, and, ordinarily, the Chesapeake & Ohio does not consider that welding is necessary until a substantial number of joints per mile are battered 3/64 in. or more. In such track, however, many joints have less than this amount, but in going over the track all joints are given such attention as they may need. Whether the batter is 0.03 in. or more, the rail ends are rebuilt by welding, while those with less than 0.03 in. are upset or reshaped by forging, since it is considered to be uneconomical practice to leave the track with any irregularities in rail surfaces at the joints.

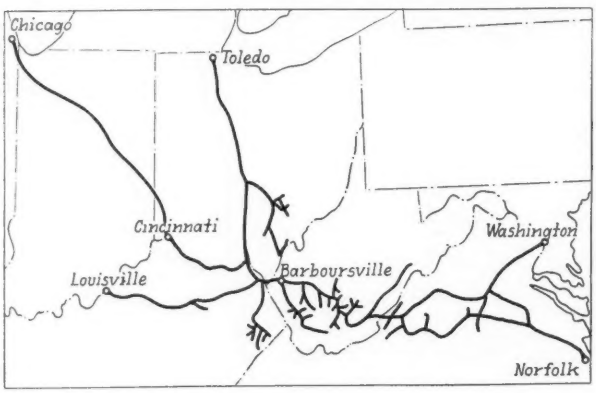
Where the rail ends are rebuilt by the oxy-acetylene process, it is the practice to shape and smooth the rail heads with hot-cut chisels and specially designed flatters, as a thorough working of the metal to insure uniformity of internal stresses after cooling is considered desirable in rails subject to heavy freight traffic. Quality of work is of paramount importance. Where pronounced inequality of rail heights exists, or where extremely quiet riding track is essential for passenger traffic, power grinders are used to finish the welds, as is done in the case of all ends rebuilt by the electric-arc method.

The maintenance officers of the Chesapeake & Ohio are convinced that rail ends should be bevelled to prevent end flow if the full benefit of welding and heat treatment is to be obtained. Consequently, cross grinding is included in the conservation measures of this road, and a cross

grinder is part of the equipment of each welding gang. In fact, investigation to determine the economic benefit derived from cross grinding has shown it to be considerable in conserving the life of rail, particularly when coupled with heat treatment.

Other conditions being equal, the life of rail is affected 100 per cent by use, that is, by the tonnage passing over it. Since the first and most severe damage always occurs at the joints as a result of batter prior to the cold rolling, the practice of hardening the ends of rails was started in 1932 to retard the rate of batter. Heat treatment to produce this hardening is applied to both new rail and rebuilt joints, a Brinell hardness ranging from 325 to 400 being obtained quite uniformly after heating, quenching and drawing.

Both gas and electric hardening have been employed for new rail, but of late rail is being purchased with the ends hardened and chamfered at the mill. None of the rail with heat-treated ends has as yet been removed, so that exact figures are not available as to the added life that may be expected from this process. On the other hand, progressive batter measurements which have been taken and compared with readings on rail that has not been hardened, indicate a substantial increase in life as a result of the hardening.



The Heavy Traffic of the C. & O. Originates in the Coal Fields of West Virginia and Eastern Kentucky

Welding Not Enough

It has long been recognized that welding of itself, including the incidental hardening and slotting of the rail ends, will not produce the results desired in conserving the life of rail unless measures are taken to compensate for wear on the fishing surfaces. In general, reformed bars have been found to give the best results under the traffic conditions on this road. Recognizing how intimately bolt tension is connected with wear on the fishing surfaces, the officers of the Chesapeake & Ohio are aware that this factor should be so controlled as to minimize wear. Experience has shown that not only is it essential to maintain tight bolts but it is of equal importance that the tension in all bolts be uniform, and such uniformity is not obtained when bolts are tightened manually. For this reason, a sufficient number of bolting gangs, equipped with power wrenches, are employed to insure that all track bolts on the system will be kept properly tightened. To provide minimum variation in this respect, the machines are periodically tested and adjusted.

Curve Greasers Effective

Since the Chesapeake & Ohio is a mountain road, curvature is an outstanding characteristic of its alinement, with many curves ranging from three to six degrees and some even sharper than that. Obviously, curve wear had always been an important factor in the life of rail on this road. In some of the more acute cases in the earlier days, hand greasing was resorted to as a means of reducing abrasion, but as the expense involved was prohibitive, the use of this method was not general. In 1928, however, a few automatic rail and flange lubricators were installed, and they gave such excellent results in reducing wear that these installations have been extended until today there are approximately 400 lubricators in service.

As a result of these installations, curve wear has ceased to be the problem it was formerly. In fact, it is the unanimous testimony of the maintenance officers that wear on the outer rail on curves has been reduced to such an extent that rails are no longer removed from the high side of curves because of flange wear, although formerly there were many places where their life was measured in months.

One of the most interesting operations in connection with the conservation of rail on the Chesapeake & Ohio is the system of rail reclamation. This is done at Barboursville, W. Va., at a plant which is maintained for salvaging all types of track and signal materials. As the rail is released it is shipped to the reclamation plant where four classifications are made. While it is being unloaded, the scrap is segregated and transferred from the incoming cars to other cars which are ready for shipment as soon as they are loaded and weighed.

The remaining rail is sent to the saws, where 12 in. is cropped from each end, and bolt holes drilled. The sawed rail is then inspected carefully and given three classifications: (1) Rail suitable for further use in primary and important secondary lines; (2) rail suitable for branches of lighter traffic, passing sidings and other important and frequently used sidings; and (3) rail suitable for yard tracks, industrial and other sidings. Each of these classifications is further divided into 1, 1A, 2, 2A, 3 and 3A, depending on the amount of wear on the running surface. This is done to avoid mixing rails of different height.

Adzers Important

Among other measures, the Chesapeake & Ohio considers mechanical tie adzers as important adjuncts to rail renewal, because they insure a full and level bearing for the tie plates, while the large tie plates used on this road also insure minimum out-of-level settlement in service.

The use of anti-creepers is also viewed as a conservation measure, since the application of a sufficient number to hold the rail in place will keep the expansion allowance uniform.

Still another measure of prime importance in the conservation of rail, as the officers of the Chesapeake & Ohio view the matter, is heavier and stiffer rail to offset both increased wheel loads and an increasing volume of traffic. This practice has been followed progressively from 1901 to date. In fact, it was the only method for improvement in this respect between 1901 and 1928, except such welding as was done subsequent to 1923. Since 1928 there has been a marked increase in the weight of rail laid year by year, the present standard being 131 lb. for all heavy-traffic main line tracks. The weight of rail in secondary lines has also increased progressively through the use of Class I relayer rail to replace lighter sections.

In addition to the practices which are being employed consistently for

Heavy Rail, Large Tie Plates and an Ample Number of Rail Anchors Are Features of C. & O. Track Construction

the purpose of increasing the life of rail, a large amount of experimental work is under way constantly with various devices. Special test sections of track in which different devices or practices are under study, are located at various points where track and traffic conditions are typical, or in some cases severe. These test sections are being watched closely with a view to determining the advantages or disadvantages of the devices or practices under test. Complete records are being kept so that a determination can be made on the basis of both cost and the effect on track conditions.

Test Tracks

To mention only a few of the devices and practices now under study, there are three separate tests of GEO and one of M. & L. track construction. For purposes of comparison, a section of similar length, approximately one mile, of C. & O. standard track construction has been set aside and is under the same careful scrutiny as the sections containing the other types of construction. Similarly, two sections of equal length are equipped with Elastic spikes. All of these tests are being conducted on 131-lb. rail.

To determine the relative advantages, as compared with ordinary rail, of the various means which have been proposed for improving the quality of rail, test sections have been established for the study of normalized and controlled cooled rail, and of rail that has been given special heat treatment in a lead bath. A similar test is also being conducted with head-free rail which has been given no special treatment.

Studies are also being made of various methods for improving the performance of the rail at joints. Among these are two test sections for determining the value of the heat-treatment and slotting of rail ends. This test includes a group of joints in which the rail ends are neither hardened nor slotted; another group slotted but not hardened; a third group hardened but not slotted; while the fourth is both hardened and slotted.

Another test is being conducted to determine the relative performance and the effect on rail batter and joint bars of various types of spring washers, in which the products of different manufacturers are being compared with each other and with joints having no washers. Likewise, a comparative test is being made of gas and electric welding. Again, test sections have been laid with mitre-cut rail, and with various types of joint bars. Also, to determine the economic value of cropping released rail, a test is under way in which the performance of cropped and uncropped relayer rails is being studied.

Economic Studies

Obviously, most of the practices which have been described are so inter-related that it is impracticable to segregate them and say categorically that any one has had such and such an effect on the life of rail or on track conditions, or that it has a certain economic value. On the other hand, comparative studies, such as some of those mentioned, have provided a fund of detailed information of great value with respect to the effect of these practices and materials, and have shown their importance in extending the life of rail, even though it may not be possible to segregate the effect of each measure.

For these reasons, a study has been made of the combined effect of all of the conservation practices which are being followed. In making this study, which goes back to 1901, two periods have been established, from 1901 to

(Continued on page 610)

Uneven fading of paint of brick color applied in one coat over previous paint in good condition and uniform in absorptiveness. The photograph was taken about one year after repainting. The faded areas are the thinner portions of the last paint coating.

By F. L. BROWNE†

The Fading of Painted Surfaces*

IN MOST exterior paints for wood, the colored pigments are chemically stable inorganic substances that do not change materially in color from weathering. The fading of paints containing such pigments is not caused by any change in the pigments but by loss of organic vehicle, usually dried linseed oil, from the exposed surface of the paint coating, thus leaving the outermost part of the coating with insufficient vehicle to fill in all of the spaces between the particles of pigment. Under such circumstances we might expect to find the outer layers of pigment bound together inadequately, and to the remainder of the coating. In fact, we find that the loose pigment can be rubbed off easily with the fingers or a piece of cloth of a color contrasting with that of the paint. In other words, fading begins when the paint begins to chalk.

Why chalking causes fading may be demonstrated by mixing thoroughly enough dry iron oxide red, or other colored pigment, with dry white lead or zinc oxide to make a mixture very light pink in color. Save part of this mixture for comparison and rub up the remainder with linseed oil to the consistency of paint. The paint will have a far deeper red color than the mixture of dry pigments. Chalking and fading are the reverse of this experiment, in that oil is taken out of the exposed surface of the paint leaving the pigments dry. It should also be remembered that such pigments as silica, whiting and barium sulphate, which are transparent in linseed oil, are opaque and white in the form of dry powder and, therefore, help to cause fading when paint begins to chalk.

Fading Expected

Ordinarily, chalking is the preferred form of deterioration for exterior paints on wood. Fading is, therefore, a result that must be expected. Before choosing a tint in the first place, the faded appearance as well as the initial appearance should be considered. Some tints look well in both the initial and faded colors, while others that may be very attractive originally look shabby when faded. In any case, painting should be done so that all parts of a building that can be viewed from any one position will always be as nearly uniform in color as practicable, except where different colors are chosen deliberately to begin with.

There are several kinds of lack of uniformity in fading, some preventable and others not. Paint deteriorates most rapidly on those parts of a building most fully exposed to sunshine. As a rule, therefore, fading begins earlier on the south side than on the north, unless the south side happens to be in the shade of another building. Fortunately the south and north sides cannot be observed from any one position.

Even if the east and south sides, for example, are seen at one time a reasonable difference in color may merge in the viewer's impression with the difference in intensity of illumination of the two sides. This kind of lack of uniformity in fading, which is unavoidable, causes little trouble unless the extent of the fading is excessive or the color is one that looks very shabby when faded.

Some kinds of paint begin to

*This discussion was submitted for publication in What's the Answer department for the July issue, in answer to a question as to what causes parts of repainted wood surfaces to fade. Because of its scope, however, it was withheld for presentation here as an independent article. For further discussion of the subject, see page 489 of the July issue.

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chalk and fade at an earlier age than others. With any one kind of paint and a given exposure, fading will begin earlier the greater the proportion of pigment and the smaller the proportion of organic vehicle in the exposed layer of the dried paint coating. If this outer layer of paint does not have a uniform content of organic vehicle, some parts of it will fade earlier than others.

Uneven fading of this kind is always objectionable, even though both the original and the faded colors are in themselves attractive. Except under a few rather unusual circumstances, uneven fading caused by uneven composition of the last coat of paint can be charged definitely to bad craftsmanship on the part of the painters or to unreasonable limitations of time and materials imposed on the painters by their supervisors.

On a non-absorptive surface, a coating of new paint dries with uniform composition, determined entirely by the proportions in which the paint was mixed. On an absorptive surface, however, part of the linseed oil is taken out of the coating to saturate the surface beneath. As a result, parts of the new coating dry with less oil than others, and these parts will fade sooner.

If the old paint is uniformly absorptive and takes the same amount of oil from the new paint over all parts of the surface, the composition of the new coating might still remain uniform, if the coating were applied with the same thickness everywhere. Few painters are capable of such meticulous craftsmanship, however. Almost always there are areas thicker and thinner than the average. If so, the thin areas lose proportionately more oil and fade sooner, while the thick areas fade later than the rest of the coating. Uneven fading of this kind is not uncommon. The writer has even seen cases in which the hollows of the brush marks faded earlier than the crests.

In general, an old paint is uniformly absorptive up to the age at which it begins to break up seriously by cracking, crumbling, flaking or scaling. A nice question of painter's judgment arises in determining whether one or two coats of new paint are needed over a substantially unbroken coating of old paint. From the viewpoint of assuring uniform fading, obviously, two coats are much safer. On the other hand, repeated repainting with two coats before a large part of the previous coating has worn away, builds up a very thick coating that may break up early and badly.

If two repaint coats are applied, the first should be thinned generously with a volatile thinner and brushed out to 800 or 900 sq. ft. to the gallon. In this case, the object of the first coat is to saturate the old paint while adding as little as possible to the thickness of the coating. The finish coat may then be brushed out to the point at which it just hides adequately and makes a satisfactory job.

If the surface is repainted with one coat only, very little volatile thinner should be used. The paint should be mixed stiff enough—with high content of pigment—to be brushed out properly at no more than 600 sq. ft. per gal., and the coating should be laid on with a thickness as uniform as possible.

Old Surfaces Misleading

An old surface that is cracking conspicuously, but has not yet begun to flake or scale often proves to be misleading. The paint itself is usually quite uniform in absorption, but the cracks, if deep, may take much oil from the new paint. After repainting there may be early fading over the old cracks.

This occurs most frequently with paints of hard type, that should be repainted with the minimum amount of paint at a time, seldom more than one coat. The paint should be mixed to a stiff consistency with much pigment, and should be brushed down into the cracks as thoroughly as possible before it is finally leveled off by the last strokes of the brush.

When the old coating has started to break up by crumbling, flaking, or scaling, exposing bare wood, the absorption of the surface is quite variable and two coats of new paint are necessary. All loose paint should first be scraped off and the jagged edges tapered off by sandpapering. Even with two coats of new paint there is danger of uneven fading, unless the first coat is thinned and applied properly.

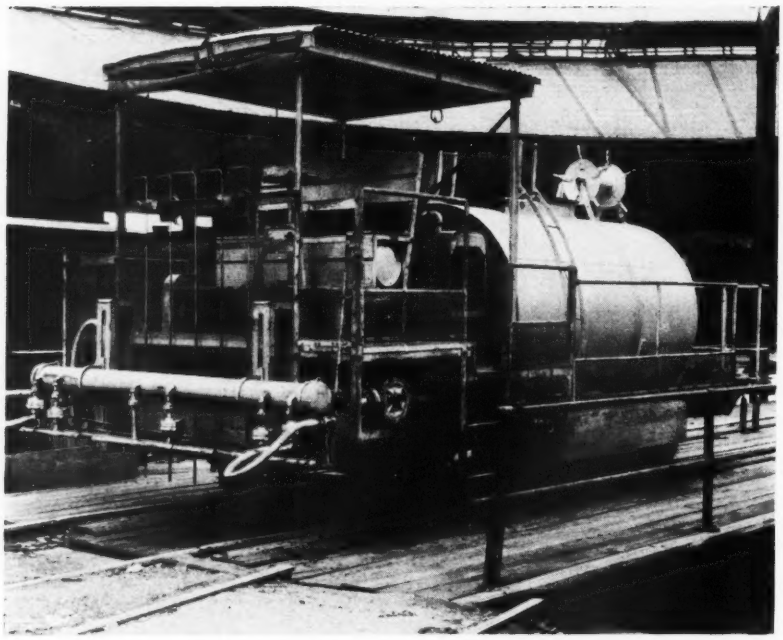
A very common blunder is to thin the first coat with much linseed oil on the theory that the way to satisfy excessive suction is to put plenty of oil into the paint. This theory overlooks the important matter of spreading rate. The more oil there is in the paint the farther the painter brushes it out, and the less oil there is left per unit of area. Moreover, the thinner the coating the greater the change in its composition caused by withdrawal of a given amount of oil per unit of area. Consequently, the problem of excessive absorptiveness should be met with paint mixed with plenty of pigment, no added volatile thinner, and application in a coating of substantial thickness. Such a repaint coat will prime the surface adequately and hold out the finish coat so that fading will be uniform. It will also come far closer to leveling off the flaked patches with the rest of the coating.

There are many badly neglected surfaces that ought not to be repainted without first removing all of the old paint from them. When old paint is scaling from the wood in places but the portions remaining are thick, curling at the edges, yet resist dislodgement by the scraper, the behavior of a repaint job is uncertain at best. Again, on a surface on which various types of paint have been used and part of the coating is slipping over or curling away from previous coatings, it is wise to take off all of the old paint and start from the wood with a properly planned program for future maintenance of the surface.

One other factor affecting the uniformity of finish coats may be mentioned. Absorption of oil by the underlying surface goes on for some hours after fresh paint has been applied, but it can continue only so long as the oil in the new paint remains liquid. Reasonably rapid drying of the new paint will, therefore, assist in sealing the surface against further absorption.

Many painters are unduly cautious about adding drier to paint. While overloading paint with driers should be avoided, it is equally bad practice to restrict the drier to such an extent that the paint remains wet abnormally long. In good weather paint should dry to a firm film overnight. Slow drying is particularly likely to occur with dark-colored paints containing no lead or zinc pigments. When repainting with two coats of brown paint, for example, the first coat, even after it seems to be firm, sometimes has the property of absorbing oil from the second coat. The writer has seen this occur to such an extent that the finish coat dried without gloss.

To avoid such possibilities it is wise to repaint before it becomes necessary to use more than one coat of new paint. When two coats are necessary, it is sometimes advised to use for the first coat white-lead paint tinted toward the color of the finish coat and then to use the colored paint for the finish coat. The writer does not endorse this procedure, because the application of white or tinted white paints over colored paints containing no white pigments, has been known frequently to cause unsatisfactory paint service.



One of the Three Combination Weed Spraying and Fire Fighting Units Constructed by the Southern Pacific Lines in Texas and Louisiana.

Spray Cars Embody Noteworthy Features

Three units constructed by the Southern Pacific Lines in Texas and Louisiana are designed for use either in sprinkling chemical weed killer on the track or as fire-fighting equipment.

A TRACK-MOUNTED self-propelled car designed for use either in spraying chemical weed-killer on the track and roadbed or for the application of water to the right-of-way and structures in fire-fighting service has been developed by the Southern Pacific Lines in Texas and Louisiana. Noteworthy among the features embodied in this car are the high degree of flexibility with which water or chemical weed-killer may be applied, the provision of means of obtaining water from streams in the vicinity of the track as well as from roadway water stations, and the use of wrought iron in the construction of the storage tank and delivery pipes in order to secure increased resistance to corrosion. Three cars of this type are now in service, all of which have been built in the company's shops.

Tank Holds 2,000 Gal.

These cars are each mounted on an electrically-welded structural steel chassis carried on two roller-bearing mounted axles which are 12 ft. apart. Mounted on the chassis in such a position as to overhang the rear axle about two feet is the cylindrical storage tank, which is 5 ft. 9 in. in diameter and 10 ft. long and has a capacity of approximately 2,000 gal. This tank is constructed of 3/16-in. wrought iron plate.

The power plants, pumps, spray nozzles, controls and other operating parts are mounted on the chassis at the forward end which overhangs the front axle about 4 ft. 6 in., the various parts being so arranged as to secure an even distribution of weight over the two axles. The forward end of the car is provided with a timber platform and is covered with a corrugated metal canopy. It also carries the operator's seat which is so arranged as to place all controls within convenient reach of the operator and to afford a clear view of the track in both directions.

The chassis has a total length of 20 ft. and a width of 9 ft. Pipe safety rails 3 ft. high, broken by the necessary openings to permit access to the front and rear platforms of the car, extend along the sides and front of the forward platform as well as along the edges of the timber walkway that is provided along the sides and rear of the tank and which is 18 in. to 24 in. wide. As a further safeguard to prevent objects falling from the platforms or men losing their footing, each safety railing is screened with wire mesh for a height of 12 in. above the floor except along the front of the operator's platform where the wire mesh has a height of 24 in.

Power Plants

Power for propelling the car is provided by a 30-hp. Waukesha gasoline engine which is connected to the front axle by means of a double roller-chain drive. All shafts are mounted on roller bearings and flexible couplings are provided. A separate power plant, consisting of an 8-hp. 2-cyl. gasoline engine, is used to operate the spray pump. The latter unit, which consists of an orchard-type pump, is also connected to the engine by means of a

roller-chain drive. Pressure in this pump can be raised to 500 lb. per sq. in., but to date it has not been necessary to use pressures greater than 200 lb. per sq. in.

Sprinkler Equipment

The spray equipment on the car embodies a 6-in. by 96-in. header or manifold mounted transversely on the front end of the car, to which the liquid is conveyed from the tank by high-pressure pipes of wrought iron. From the header the liquid is distributed to three fixed sprinkler pipes, also arranged transversely, one for spraying the space between the rails, and one at each end which distributes the liquid in the space between the rails and the ends of the ties. The middle sprinkler pipe has five nozzles and the outside pipes each have three. Mounted on each side of the car at the front end and also connected with the manifold is another sprinkler pipe carrying four nozzles, which permits the sprinkling of that part of the ballast and roadbed between the ends of the ties and a line 9 ft. from the center line of the track. Each of these pipes is swiveled at its inner end and may be raised and lowered by means of a cable winding on a reel which is operated by a hand wheel so placed as to be within convenient reach of the operator.

All nozzles used give a fan-shaped spray and have a discharge capacity of about ¾ gal. per min. at a pressure of 200 lb. per sq. in. Each of the sprinkler pipes is attached to the manifold by means of a pipe connection containing a valve which is controlled by means of a lever located in front of the operator's position, there being five such levers or one for each sprinkler pipe.

Hose Outlets Also Provided

In addition to the sprinkler equipment mentioned above, the car is also provided with connections for four or more high-pressure hand-held hose outlets, each of which has a ⅛-in. jet nozzle and a central control lever. These hose outlets serve two purposes. When the car is used to extinguish fires behind a weed burner, laborers handling hose outlets are stationed at each front corner of the car, and at the rear corners if necessary, to extinguish fires in the ties or on the right-of-way outside the track. The hose equipment is also used to spray chemical weed killer around and under timber bridges, special valves and nozzles being used for this purpose.

When operated in connection with track weed burners the cars usually follow the burner units. In such service the watering equipment is used as needed, the sprinkler system at the front end being operated continuously or intermittently as conditions require, while the hose outlets are used as described above. In some instances the cars are operated ahead of weed burners, in which event the spray nozzles are operated continuously to wet the ties. In such instances it is said that, under proper conditions, the wet vegetation is more thoroughly destroyed than when it is burned when dry. The water cars are operated in advance of the burner only when it is felt that there is no danger of right-of-way fires getting beyond the control of the section gang which follows the weed burner.

Advantages as Chemical Car

As a means of applying chemical weed killer this car has proved satisfactory in service, being less costly and at the same time more flexible in operation than a work train. One advantage is that it facilitates the spraying of vegetation under bridges. It has been the experience of the Southern Pacific that better results can be obtained by spraying weeds with a strong solution, finely divided to secure thorough coverage, than with larger quantities of a weaker solution.

The new cars are so designed that water may be taken into the tank either from roadway water stations or from a stream or body of water adjacent to the track. For securing water from locomotive supplies a large trap door opening is provided in the top of the tank, into which water is directed through a canvas tube 5 ft. long that is inserted over the spout of the crane or elevated tank from which the supply is being obtained.

For filling the tank from bodies of water adjacent to the track a Fairbanks, Morse rotary pump with a capacity of 200 g.p.m. is provided, and a 30-ft. suction hose with a foot valve is carried as standard equipment. This pump, which is operated from the main shaft of the propelling engine, is by-passed so that it can be used in case of emergency to pump water out of the tank, thereby giving the unit added effectiveness as a piece of fire-fighting equipment. For use with this pump 100 ft. of standard 1½-in. fire hose with a nozzle is provided on the spray car.

We are indebted for the information contained in this article to R. W. Barnes, chief engineer of the Southern Pacific Lines in Texas and Louisiana, under whose supervision the new type of water and chemical spray car was developed.

When a Pier Settles*

By A. R. Ketterson
Assistant Engineer of Bridges
Canadian Pacific, Montreal, Que.

THIS discussion is based on the assumption that the settlement of the pier is caused by overloading and not by scour; that the effect of the settlement on the pier shaft has not been such as to require that it be rebuilt; and that the general conditions at its site do not prevent strengthening.

As a general rule, the first step in the major effort to overcome the settlement is to relieve the pier of its superimposed load. Sometimes, if the spans it supports are short and their reaction on the bridge seat does not add appreciably to the dead weight of the pier itself, it may not be necessary to support them independently during the progress of the work. It is preferable to do so, however, where the substructure carries spans of considerable length, to eliminate not only the weight which their reaction imposes on the foundation, but also the vibration which is practically always present unless the substructure unit is of very large mass. It will also be advisable to consider whether it will be necessary to shore the shaft laterally as a precaution against any tendency to tilt during the process of the work.

Assuming that this procedure has been carried out, the next aim is so to construct the extended footing that it will have its quota of the total load transmitted effectively to it from the

*This discussion was submitted for publication in the What's the Answer department in the July issue as an answer to the question as to what should be done when a pier settles from overloading, but because of its scope it was withheld for publication here as an independent article. For further discussion of this subject, see page 488 of the July issue.

existing masonry. To insure this it is advisable that the new footing be carried in underneath the existing foundation. The distance that it should be carried in under the old footing will depend largely on the cohesive qualities of the foundation soil.

Obviously, it is useless to attempt underpinning unless the excavation can be made safely to a point where the shear value of the existing footing is sufficient to transmit that quota of the estimated pressure which the extension must carry if it is to have any value. For instance, if the pier has only one footing course 2 ft. thick, which projects 1 ft. from the shaft, the new footing should be carried back under the shaft itself. If, on the other hand, there are several stepped footing courses, the underpinning need be carried under the existing footing only to a point where the shear value of the combined footing courses immediately above is sufficient to transmit that part of the total pressure which must be taken by the extension.

To create the least possible disturbance to the soil under the pier, the excavation for the new footing should be carried out in short sections, and each section should be concreted before an adjoining one is opened. Extreme care should be exercised when excavating under the pier to insure that a "run" does not develop, which might affect the consolidation over an area greater than that being excavated. As a precaution against such an occurrence, the sides of the section being excavated should be bulkheaded securely, and the concrete should be placed immediately after the excavation is completed.

A liberal quantity of steel reinforcing should be incorporated in the new work. The rods which are to project out from under the existing masonry should be of large diameter and, if piles are to be used under the extended toe, these rods should be grouped over the pile tops. Old rails cut to the proper length are generally considered to be quite suitable for this reinforcing.

Since the excavation is to be carried out in short sections between bulkheads, the longitudinal rods will also need to be in short lengths. Their ends can be allowed to project through the bulkhead into the adjoining unexcavated section, however. When this latter section is excavated, these ends should lap and be wired to short lengths placed in that section, or be hooked to them. If stout rods are used, there is usually no difficulty in driving them into the adjoining soil through holes in the bulkhead.

Since the main object of the work is to insure that the foundation load will be spread over a larger area, it becomes advisable, in addition to carrying the new footing underneath the existing one, to build a jacket from the new footing, which will entirely envelop the pier. This jacket should be carried up to the ground line, although it is sometimes advisable to bring it up to the bridge seat. To do this the existing coping course must be removed and the new coping course should be deposited monolithically with the jacket.

It is advisable to place both vertical and longitudinal reinforcing in the jacket, and to key it well to the shaft of the pier. If the pier is of quarry-faced stone, the rough projections of which will provide the key, it will only be necessary to drive dowels at frequent intervals in the vertical joints between the stones. If the shaft is of concrete or full-dressed stone, with few or no projections, it will be desirable to cut deep horizontal chases around the shaft to provide a "shoulder" for the jacket.

If foundation and clearance conditions permit a thick jacket to be carried up and constructed monolithically with a new bridge seat of liberal depth, the question of underpinning may not be so important. In cases where this is not feasible, however, the writer is of the opinion that the new footing should be carried under the old one. Otherwise, the extension will be compelled to rely entirely on bond and dowels for the transfer of its quota of the load.

Train Finds Kink That Foreman Missed

ACCORDING to the report of the Bureau of Safety of the Interstate Commerce Commission, failure of the section gang to find and correct a reported defect in the track was a contributing cause of a derailment on the Pere Marquette east of Michigan City, Ind., on March 7, that resulted in injuries to five members of the train crew.

At 7:30 p.m. on the night of the accident, the crew of an eastbound freight train discovered that the draft gear and end sill had been pulled out of one of the cars, and subsequently discovered that the track had been pushed out of line some 12 to 16 in. at a point about six car lengths to the rear of where the draft gear was found lying on the track. The conductor reported the condition of the track to the dispatcher and at 9:35 the section foreman, who had been informed of the defect, loaded some tools in his automobile and drove with several members of his gang to the location indicated by the message he had received.

He found the draw bar and examined the track for about 200 ft. westward, but as he did not find the kink in the track in this distance or any evidence of dragging equipment, he concluded that the conductor had been mistaken and reported that the track was in safe condition. The restrictive order that had been issued by the dispatcher was then annulled and at 11:35 p.m. an eastbound time freight was derailed at the location of the kink.

Long Life from Rail

(Continued from page 605)

1927 and from 1928 to 1937, both inclusive. This division was made because during the earlier period the principal conservation measure undertaken was to lay heavier rail, except such welding as was done between 1923 and 1928, while all other conservation practices now in effect have been inaugurated since 1927.

It is a generally accepted premise of rail renewal economics that requirements bear a direct ratio to miles of track and traffic density, so the net effect of all the foregoing methods employed to conserve the life of rail may be summarized as follows:

During the earlier period, an average of 24,722 tons of new rail was laid per annum. In the later period, the main track mileage had increased 57 per cent and traffic density 59 per cent over the earlier period. Therefore, had the same methods of rail maintenance prevailed in the later period as in the earlier period, there would have been required an average application of 61,714 tons of new rail per year. Actually, there was applied in the latter period an average of 45,344 tons per annum, which, it will be noted, is an annual saving of 16,370 tons of new rail, or a decrease of 26.5 per cent in rail maintenance cost.

Coincident with this saving in rail application, a decided improvement in the uniformity of rail condition in track has brought about a generally better track condition as a whole, which facilitates the efficient handling of traffic.

Left—All of the Plank Platforms at the Road's Passenger Station at Richmond, Va., Have Been Treated With the Asphalt-Sand Top Dressing. Below—This Section of Asphalt-Sand Coated Station Platform, Subject to Considerable Baggage Trucking, Has Been in Service for Several Months Since the Coating Was Applied.

The Chesapeake & Ohio has found that a thin asphalt coating, impregnated with sand, spread over plank platforms used for heavy trucking or foot traffic, will increase the service life of the plank from two to three times, depending upon conditions, and also offers a number of other advantages. A description of the coating employed and of the method of its application is included in this article.

Asphaltic Surface Increases Life of Platform Planking

BY THE SIMPLE expedient of applying a thin coating of asphalt emulsion and sand to the surface of plank platforms, the Chesapeake & Ohio is materially increasing the life of the planking in such platforms, with a sizable reduction in maintenance and renewal costs. At the same time, the new wearing surface provided affords several advantages over the bare plank surface, and can be applied at small cost with a minimum of interruption in the regular use of the platforms.

Any Timber Deck

About four years ago plank platforms at several outlying passenger stations on the C. & O. were treated with an asphalt and sand surface coating. Since that time, many such platforms in a wide variety of services have been coated to advantage, including storehouse, freighthouse and shop platforms subject to heavy trucking. In addition, the treatment has been applied effectively to timber floors within shops, piers, warehouses, etc., where mechanical wear of the planking is a problem.

The asphalt surface treatment is adapted equally to new or old floors, and has been applied with equally satisfactory results to both creosoted and untreated timber. In the case of creosoted planking, however, it is desirable that there be no free creosote on the surface—in other words, the application of the asphalt to newly treated wood should be delayed until all free creosote has evaporated from the surface. This insures a better bond of the asphalt to the timber surface.

Readily Applied

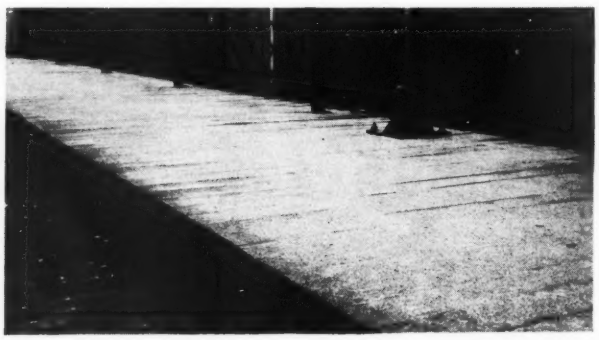
In the coating of timber platforms and decks on the C. & O., both soap-type and clay-type asphalt emulsions have been used successfully, but, because of its lower cost, the road is now using the soap-type emulsion exclusively. This material, purchased in drums, is shipped directly to the site of the work and is applied by means of a long handle fibre brush. Depending upon temperature conditions and the condition of the planking, the emulsion is applied as received in the drums, or diluted with up to 10 per cent of water. The governing factor in this regard is to have a mixture that will brush out uniformly in a film about $\frac{1}{16}$ in. thick. This appears to be the most desirable thickness.

If the plank surface to be coated is securely spiked and clean, no advance preparation is necessary for the application of the emulsion, other than to replace any planks sufficiently worn or deteriorated to require renewal before the surface coating is applied. The plank may be wet or dry at the time of applica-

tion, but there should be no free water on the surface, and the work should not be done in the rain. If the plank is wet, it has been found that the moisture in the plank compensates for a certain lack of water in the emulsion, permitting the use of a stiffer mix, whereas in the case of a perfectly dry surface, slightly more water is necessary in the emulsion to permit ready brushing and to secure a good bond with the wood.

Covered with Sand

Immediately following the application of the asphalt dressing, the surface of the platform is sprinkled with sand, which is intended to be driven into the asphalt under foot or wheeled traffic to form a wear-resisting surface. The sand is applied by means of a simple hand sieve, being spread on uniformly to a depth of approximately ⅛ in. This is considerably in excess of the amount of sand which will be embedded in the asphalt, but it insures an adequate quantity for this purpose, and, at the same time, presents a surface which



A Newly Coated Platform Showing the Surplus of Sand Applied Over the Surface

can be used shortly after the work is completed. Usually, three to four hours time is sufficient to allow the top coating to set before it is put under traffic. Following such a period, traffic firmly embeds the sand in the stiffened asphalt, forming a hard wearing surface which adheres tightly to the plank.

The sand best suited for use in the surface coating is a sharply angular silica or quartz sand. After the newly treated surface has been subject to traffic for a week or more, depending upon the character and uniformity of the traffic, any surplus sand can be removed and reused elsewhere, if desired.

Several Advantages

Experience with the asphalt surfacing on timber platforms and floors on the C. & O. indicates that the coating accomplishes several desirable features in prolonging the life of the planking. In the first place, it tends to waterproof the surface, sealing most of the smaller cracks; it absorbs the abrading action of foot and wheel traffic, keeping it entirely from the timber and thereby avoiding wear and splintering; it tends to even off irregularities in the surface due to slight differences in the thickness of the planking; and it presents a non-slip surface. It is also said that the asphalt-sand coating reduces the fire hazard of both untreated and treated planking, and prevents the unsightly marking and charring of the plank caused by discarded cigarettes and cigars. In addition, it has been made evident that where the asphalt coating is to be applied, softer and less expensive timber for planking may be used successfully, with no disadvantages.

Avoiding Bunching

Under certain conditions there is a tendency for the coating to bunch slightly, but this can be avoided if the thickness of the coating is limited to $\frac{1}{16}$ in. and care is taken to secure good adhesion of the asphalt to the timber. Even such slight bunching of the asphalt as may occur is said not to be objectionable to passengers or employees, or from the standpoint of trucking.

Under the same conditions of traffic, the asphalt coating holds up better in covered locations, away from the action of the sun and rain. Depending upon conditions, it has been found desirable to renew the coating every two or three years. By so doing, it is expected, on the basis of experience thus far, that the life of the planking can be doubled or tripled.

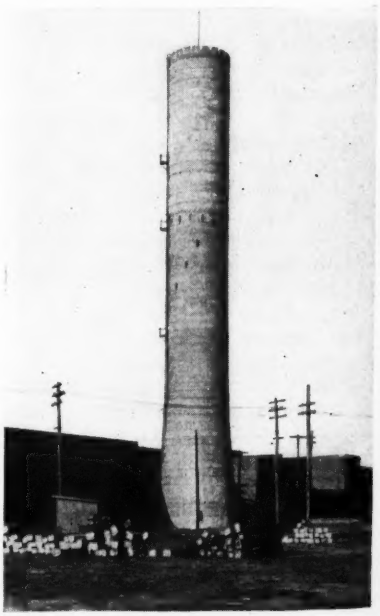
The work of applying the asphalt-sand coating to platforms on the C. & O. has been carried out by the regular bridge and building department forces of the road, under the general direction of the engineer maintenance of way and the general supervisor of bridges and buildings.

More Welded Track

(Continued from page 600)

demonstrated that long rails, without expansion gaps, can be produced and handled into the track successfully, and are entirely practical, at least under the main line conditions and service to which they have been subjected. Most of the installations of long rails on the D. & H. have been made in stone-ballasted tracks, but it is interesting to note that approximately 14 track miles of the long rails in the 1937 program have been laid in cinder-ballasted tracks, and have already gone through a period of hot weather without presenting difficulties.

All of the rail welding on the D. & H. has been carried out under the immediate direction of H. S. Clarke, engineer maintenance of way, who is responsible, initially at least, for the development of the electric flash butt welding machine which is now being employed in the rail welding work. The early developments in the flash welding equipment were carried out by the General Electric Company, Schenectady, N. Y., while all of the later developments, including the arrangement of the portable outfit for permitting the welding to be done at different locations, have been carried out by Sperry Rail Service, Inc., Brooklyn, N. Y. The Thermit joint welding which is now being done on the D. & H., is being carried out largely by company forces, with its own equipment, employing Thermit metal furnished by the Metal & Thermit Corporation, New York.



Reinforced Concrete Water Tank on the Central of Georgia at Savannah, 187 Ft. High, Built in 1909

What's the Answer?

Joint and Intermediate Ties

What is the relative life of joint and intermediate ties? What factors cause this difference? What can maintenance forces do to equalize the life?

Needs Well-Designed Joint

By G. A. Phillips
Chief Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

If a well-designed joint bar is used, proper expansion or gap between the rail ends provided and the ties are protected with adequate plates, I do not believe that there will be much difference in the life of joint and intermediate ties. There will be, however, some slight abrasion on the bottom of joint ties as a result of the additional tamping which all joint ties are likely to receive. This is based on the assumption that, in general, good maintenance practices prevail.

No Specific Answer

By H. R. Clarke
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Chicago

Any answer to this question must be largely a matter of opinion since, so far as I know, accurate records of the relative life of joint and intermediate ties have never been kept. When it was the custom to impose an extra load on joint ties by slot spiking the angle bar, thus putting the burden of rail anchorage on them in addition to their support of the joint, the life of joint ties was doubtless considerably shorter than that of intermediate ties. It has been estimated that under these conditions joint ties had only 60 to 70 per cent of the life of intermediate ties.

This shortened life was caused by the extra load imposed upon them. They were dragged back and forth by the movement of the rail, often being moved entirely off the compacted bed upon which they had rested originally, frequently being badly split and torn as the spikes were forced out of the tie by the pressure of the rail. This was particularly serious where the joint ties were depended on entirely for anchorage or where other anchorage was inadequate.

With the present general practice of not slot spiking joints, this additional burden is not imposed on the joint ties, thus increasing their life naturally as well as improving track conditions otherwise. Where joint ties are not slot spiked, the rail is as free to move over the joint ties as it is over the intermediate ties, and there should be comparatively little difference in the life of joint and intermediate ties. Possibly the joint ties will not give quite as long service, as there is additional impact at the joint which is transmitted to the ties, for which reason it is generally considered good practice to maintain joint ties to a somewhat higher standard than is thought to be necessary for intermediate ties.

Where the joints are not slot spiked, the maintenance forces cannot do a great deal to equalize the life of joint and intermediate ties. Since the load imposed on joint ties is greater than that on intermediate ties, the best ties readily available should be placed under the joints. The joint itself must be maintained in the best possible condition, that is, the bolts should be kept tight in the angle bars and the joints should be kept picked up and maintained to a smooth surface. Excessive rail-end batter should not be allowed to develop, for if it does, the impact on the joint is greatly increased and the consequent damage to the joint tie is greater.

When slot spiking is still practiced,

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in November

1. Is it advisable to require section forces to devote certain days each week or month to the maintenance of rail joints? Why? What are the advantages? The disadvantages?

2. What are the relative merits of gas and electric welding for structural repairs?

3. What advantages, if any, are there in precurving rail? What disadvantages? What effect do the weight of the rail and the degree of curvature have?

4. What are the relative advantages and disadvantages of steam and hot water for heating small and medium-size stations? Large stations? Why?

5. Should roadway machines, such as ballast discers, weed burners, light cranes and similar equipment, assigned to work all or part of their time in automatic-signal territory, be insulated? Why?

6. Where the variation between the high and low-water stages in a stream are much greater than the practical suction lift, how should the pumps be located? What precautions are required?

7. Should a yard gang include one or more assistant foremen? Why? If so, how many? What should be their duties?

8. Is it worth while to keep records of painting jobs on buildings? On bridges? Who should keep them? Where? What information should they contain?

in addition to the foregoing precautions the maintenance forces should see that the rail is anchored adequately to prevent creepage, which greatly increases the load imposed on the joint ties and results in serious damage to them.

Eliminate Abuse

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

By their very nature joints cannot avoid being harder on the ties supporting them than the remainder of the rail. For the greater part of the year the rails have some expansion opening, and even when the joint bars are new and the bolts are tight, a certain amount of impact occurs at the joint and is transmitted to the ties, to which intermediate ties are not subjected. As the rail grows older and the fishing surfaces become worn, the magnitude of this impact increases, and if corrective measures are not applied, what was originally only an unavoidable load becomes abuse.

In general, the use of anti-creepers and the abandonment of slot spiking have added greatly to the life of joint ties as compared with their average life no longer than 10 years ago. Today, the factors which affect joint ties more adversely than intermediate ties are those which have been mentioned, failure to keep bolts tight, wear on the bottom of the tie from frequent tamping, neglect to tamp when needed and foul ballast induced by too much tamping or not enough.

What the maintenance forces can do is indicated by the foregoing. They can keep the expansion gap adjusted, the bolts tight, the ballast clean and the joint ties tamped solidly. Even with the best of supervision and workmanship, however, so long as joints continue to be of the present design the life of joint ties will be less than that of intermediate ties; how much depends on the quality of the maintenance the joint receives.

Low Spots at Bridge Ends

What means can be employed to eliminate low spots at bridge ends? Does the kind of ballast make any difference? Are construction methods at fault? If so how?

Ballast Must Be Good

By R. L. Simms
District Maintenance Engineer, Chicago, Burlington & Quincy, Galesburg, Ill.

To have smooth-riding track at bridge ends, proper construction of the approach is the first important factor. The fill must be made of stable material, have wide shoulders, extend far enough beyond the first bent to afford support and the bulkhead should be deep and wide enough to prevent settlement. The ends of open-deck bridges often ride bad because the bridge is rigid while the fill approaching it has some elasticity, and the sudden change from an elastic to a rigid support makes small variations in the surface quite noticeable.

Ballast decks generally ride more smoothly at the ends, because the tamping of swinging ties can be carried out on the approach. This is not so easy with open decks, for shims may be necessary on the bridge ties and any small irregularity in the surface on the bridge may not be taken care of, since trackmen often assume that the settlement of the ties on the approach will make this unnecessary after two or three trains have passed. A good grade of ballast is also important, but the type does not make any noticeable difference.

Weakness in Approaches

By A. W. Applequist
Roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Bismarck, N. D.

Low spots at bridge ends are caused by weakness in the approaches. The bridge deck is solid, whether it is timber, steel or concrete and will carry the load with little, if any, settlement under the load, while the track on the approach is subject to some settlement under traffic. This settlement results from weak shoulders on both the ballast and roadbed, especially on high fills, where the material works away from the cribs, leaving the ties swinging.

Much can be done to eliminate this weakness at the ends of bridges by unloading enough good material to build out the shoulder of the roadbed to give the ballast proper support. In some cases it may be necessary to rip rap the embankment during high water.

Ballast used at bridge ends should be of the best material available, the track must be put in shape to receive the loads as they come off the bridge without too much give or uneven settlement, and special attention should be given to the tamping of the track ties at these locations.

They Are Always With Us

By Robert White
Section Foreman, Grand Trunk Western, Saranac, Mich.

As long as we have bridges we will have some with low spots at the ends, regardless of the type of ballast. Usually, construction methods are not at fault, for it is simply a case of two types of structures meeting, one of which is more solid than the other. For example, if one takes a few rail lengths of softwood ties adjacent to a similar stretch of hardwood ties, the point where they join will be somewhat analogous to a bridge end, and by careful observation one can detect the difference as he rides over them.

So far as my experience goes, the type of ballast has little to do with the development of low spots at bridge ends, so long as it is clean. It is easier to maintain the approaches with the finer types, however, since it takes less time to tamp the ties. Much of the trouble with low spots at bridge ends is the result of scant shoulder on either the roadbed or the ballast, or both. If there is not enough ballast shoulder to support the ballast under the ties, no reasonable amount of maintenance will keep the track up at the bridge ends. Also if the shoulder of the roadbed is too narrow, the ballast shoulder cannot be maintained. This is a maintenance problem which may or may not be up to the section forces. In the main, I do not consider that approaches to bridges present a serious problem if the foreman is alert, although under the best of conditions they do require a little more attention than is given to the remainder of the track.

Two Principal Causes

By B. Blowers
Division Engineer, Erie, Jersey City, N. J.

Low spots at bridge ends have two principal causes, (1) improper design and (2) improper drainage. The latter is sometimes a matter of design and sometimes of maintenance. The most common immediate cause is lack of support for the ballast section, often because the masonry was not designed to support the roadbed, the

backwall being too short or the wing walls insufficient.

This condition is often aggravated by a ballast raise without a redesign of the masonry to extend it as it should be. I consider this to be an important item in plans for reballasting and it should never be overlooked. Not only will this do much to eliminate bad-riding track at bridge ends, but it will avoid the use of unsightly cribs of old ties which the trackmen put in to cure the trouble, so far as they are able.

A bad spot may result from an improper backwall that requires too great a length of unsupported rail. It may also result from improper drainage, a condition that often dates back to the construction of the bridge, at which time drainage back of the abutments was not provided or the fill made with porous material.

These troubles can be cured later by the introduction of drainage, which can be considered an item of maintenance. In new construction these matters should be included in the design. On the other hand, so-called low spots are not always of this nature. They may be caused by improper cross level resulting from improper engineering, the cutting of the bearing plates into the masonry, poor framing of the ties at the ends of the bridge or other similar causes.

In conclusion, every low spot is worthy of individual investigation to determine the actual cause and the action necessary to cure it. Otherwise, an unusually large amount of time will be spent at this point if the cause is not removed.

Keep Joints Away

By W. H. Sparks

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Among the causes of low spots at the ends of bridges are failure to provide sufficient support to the roadbed and ballast by skimping on the length of the backwall and on the height and length of wing walls. On timber trestles, the bulkhead may not be long or deep enough and the nose of the embankment may not be far enough beyond the first bent.

Lack of drainage is a fertile source of low spots at bridge ends. The old U-shaped abutments were particularly troublesome in this respect. Again, where there is a considerable grade toward the bridge, water is likely to collect behind the upper abutment unless ample drainage is installed. Constantly wet ballast soon becomes churning ballast, which can be cured only by drainage and replacement, for no amount of tamping will avail to keep the track to good surface.

Another cause, seldom given enough consideration, is allowing joints to be too near the end of the bridge. Joints should be kept as far from the bridge as practicable, and this can usually be accomplished by laying one or two short rails before the bridge is reached.

Assuming that none of these conditions exist, low spots are the direct responsibility of the section forces. An alert foreman should know that the junction of the rigid bridge and the yielding roadbed is a place where small irregularities in the track quickly grow into large ones, for which reason special attention should be given to the surface at these points.

Air Chamber for a Pump

How is the size of the air chamber for a pump determined? Where should it be placed? Why?

Close to the Pump

By E. M. Grime

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

The air chamber should be placed close to the pump to relieve the shock caused by the water dropping back on the pump valve immediately after it has been pushed forward against the head by the action of the pump plunger. While ordinarily an air chamber is used at the discharge side of the pump, it is also of advantage to have an air chamber on the suction side of the pump. This chamber can be somewhat smaller than that required on the discharge side. It tends to relieve the shock as the suction valve closes and helps to fill the vacuum on each suction stroke. There is a noticeable improvement in the efficiency, especially of a triplex pump, when an air chamber is used on the suction as well as the discharge line.

The size of the chamber will depend on the type of pump and the working pressure. For low service, say under 75-lb. pressure, with a triplex pump of either the single or double-acting design, where the water stream is going forward with almost the same regularity as from a centrifugal pump, the air chamber may not be essential. At the other extreme, with single-cylinder, positive-acting pumps, or under higher pressures, air chambers become a necessity.

Good practice indicates that the volume of the air chamber should be about six times the piston displacement for single-acting plunger pumps, but for duplex or triplex pumps the size may be reduced to three or four times the displacement. The air chamber should be provided with a water glass, and there should be an air cock for the release of excess air and the maintenance of the proper pressure.

Where a long column of water must be set in motion as the pump starts or where the head is excessive, dependence cannot be placed on the air chamber cushion to relieve all shock. Under such conditions it becomes necessary to provide a by-pass through which water from the discharge side can be diverted to the suction side. The pump is started under light load with the by-pass valve wide open and the load is applied gradually by closing the valve on the by-pass line slowly. A relief valve sets slightly above the maximum working pressure will show the operator at what rate he can close the by-pass valve without increasing unduly the pump load. When the by-pass valve is closed completely, noiseless operation should continue by reason of the cushion provided by the air chamber.

Serves as a Fly Wheel

By Stanley Stone

Plumber Foreman, Erie, Hornell, N. Y.

As nearly as the analogy can be expressed, the air chamber on a pump serves the same purpose as the fly wheel of a steam engine. The discharge of a pump is generally equipped with an air chamber by the manufacturer. If it is not, the size can usually be determined by consulting pump catalogs. Failing this, for ordinary service it will usually be satisfactory to make the diameter of the chamber 1½ times that of the discharge line and its length 5 times the diameter of the discharge. When pumping against high heads, this volume can well be increased up to, say, 50 per cent. The inlet to the air chamber should be about ⅓ the diameter of the discharge pipe.

It should be placed as close to the pump as possible, preferably at the point where the water leaves the pump. The chamber is filled with air

which compresses during the discharge, or when a surge occurs for any reason. As the pressure of the discharge is relieved during the suction stroke, the air in the chamber expands and acts as an accelerating force to keep the column of water moving. While this force diminishes as expansion progresses, it tends to keep the velocity of the moving column more nearly uniform.

An air chamber on the suction line is also of advantage. In this case it acts as a vacuum chamber and assists in starting the water in the suction line, as well as equalizing the flow during the different stages of the stroke. On either the suction or discharge end, an air chamber relieves the pump of a great amount of strain and increases its efficiency. This refers only to displacement pumps for, obviously, air chambers are of no value on centrifugal pumps because there is a continuous flow into and out of pumps of this type.

Pulling Steel Sheet Piling

What methods can be employed to pull long steel sheet piling from cofferdams?

May Be a Problem

By Supervisor of Bridges and Buildings

This is usually a contractors problem, because foundations of such depth as to require long sheet piling are generally contracted, since a railway can seldom afford to maintain equipment suitable for this class of work. Occasionally, however, company forces are called on to do work requiring the use of long steel sheet piling and, unless they have had some experience with this type of piling the recovery of the piling may present a serious problem.

If the piles are not more than 20 to 25 ft. long and were driven through earth, they can sometimes be pulled with a 20 or 25-ton bridge derrick. If the driving was hard or through gravel, particularly if large stones were encountered, the bars may have been distorted, in which case a larger-capacity wrecking derrick may be needed. In both events they must be close enough to the track to avoid too long a radius.

For longer and more resistant piles I have used a heavy A-frame constructed of sound second-hand stringers, each leg being formed by bolting two stringers together to form a 16 in. by 16 in. post. Remembering that this A-frame must take a load greater than the capacity of the wrecking derrick, the crossbar should be made correspondingly strong. For this reason it is well to use two 12-in. by 14-in. timbers, set one over the other. The capacity of the blocks is equally important, and they should have not less than five sheaves for 1¼ or 1½-in. cable.

Extreme care should be exercised in guying the A-frame, for while it is intended for a straight pull only, the load may be so great that even a slight eccentricity may place a heavy strain on the guy lines.

Suggests Steam Hammer

By General Inspector of Bridges

Difficult as it sometimes is to drive steel sheet piling, it may be still more difficult to pull them, particularly if they have been considerably distorted in driving. I assume that the question refers to cases in which the piles are too resistant to be recovered with a derrick or too far from the track to be reached.

We have not had many cases where very long steel sheet piles were driven by our own forces, but on several occasions we have pulled them, using a heavy A-frame and large capacity blocks. Those piles may be surprisingly hard to start, but unless they are distorted, they can usually be withdrawn without much difficulty after they have been raised, say, from 10 to 20 ft. If most of their length is through sand or clay, a water jet may reduce the pull necessary to get them started. Sometimes, too, after the first bar is withdrawn the remainder pull somewhat easier.

While I have had no experience with this method, I once saw a double-acting steam hammer used for starting the piles in a cofferdam, which could not be pulled with an A-frame. The hammer was inverted and swung from the load line of a derrick, while some changes were made in the method of admitting steam so that it received steam only on the upward (normal downward) stroke. It was connected to the pile by means of a sling and a heavy chain, and some strain was kept in the load line from which the hammer was suspended.

Match-Marking Released Rail

When rail is released, is it practical to match-mark it for laying elsewhere? If not, why? If so, what are the advantages and disadvantages?

Does Not Favor It

By C. W. Baldridge
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Match-marking can be done, but its practicability in any given case will depend (1) on the cost of loading, unloading and relaying the rails in the same order as they were laid originally; and (2) on the advantages to be gained in laying it in this way.

Considerable care must be exercised in loading and unloading and later in laying match-marked rail, to insure that the proper sequence of the rails will be maintained. Again, the rails from each side of the track must be kept separate. It usually requires considerable switching to bring the rail cars into the proper order during both loading and unloading.

Released rails are not all alike for some, being softer than others, will be more flattened, some will show more abrasion, some will have driver burns or other damage, and some will show "wear spots" where gas bubbles occurred in the ingots from which the rails were made. Such rails should not be used along with the better rails which remain free from damage. If the bad rails are sorted out, the continuity of the match marking will be broken and little, if any, advantage will be gained from the practice. Many roads have found it to be better practice to classify the rails before they are released, sorting them into classes as they are loaded. The best rails are then used in the most important places, and the second and third classes for less important service and sidings.

Improvements which have been made in track grinders in recent years permits released rail to be made more serviceable if, after being laid, the ends are built up by welding when

needed, and then ground to an even surface. Likewise, where the ends are not of the same height, but otherwise in good condition, they can be ground to the same height. This is generally better economy than match-marking the rails.

Has Abandoned Practice

By J. Morgan
Retired Supervisor, Central of Georgia, Leeds, Ala.

Formerly we followed the practice of match-marking all of our rail released from main tracks, which was suitable for important branch-line use. There were no disadvantages in doing this, while rail handled in this manner gave smoother riding track than when laid without matching. It is easy to match-mark rail as it is released and no special difficulty or inconvenience is encountered in loading and unloading it if the proper amount of care is exercised.

We discontinued the practice several years ago, after we began to recondition rail ends by welding. I have never been convinced that we were right, since by matching the rails considerable of the heavy welding will be reduced or eliminated while rails having approximately the same amount of wear will be laid together.

It Is Simple to Do

By T. E. McMannis
Supervisor of Track, Central of New Jersey, Somerville, N.J.

It is not only practical to match-mark rail when it is released, but it is very easy to do. Probably the simplest form of match-marking is to number the good rails consecutively, making the marks at relatively the same position on all rails. Any poor rails should be omitted in the numbering so that no time will be spent later in looking for the missing numbered rails, which are probably in the scrap pile. The numbers can be marked with keel, which has sufficient permanence for rails that are to be relaid within a few months. If the rails are to be stored the marking should be made with paint. It is easiest to make the mark on the rail base near one end.

There is a decided advantage in relaying rail in the same order as it was laid in the track when new, because the rail ends match more closely than with any other combination it is practical to make. There is no disadvantage in this procedure, for there should be no extra cost attached to marking the rails or to loading or unloading them. The work-train foreman can number the rails as the tongs are being placed for loading them. By ordinary care when unloading, the rails can be picked out in order as easily as indiscriminately.

Does Not Wear Uniformly

By Engineer Maintenance of Way

It is practical to match-mark rail released from important main tracks, provided it is to be relaid immediately, in which event it can be laid in the same order as released. Where care is exercised in loading so that rail from one side only is loaded in any car and the rail is unloaded in the same order as it was loaded it becomes entirely practical to lay it in the same order as it was laid originally. Where the rail is to be stored for some time before it is reused, and then reloaded for shipment to the point of use, match-marking is not practical.

Rail does not wear uniformly at all joints, while rail released from curves does not match that from tangents, for which reasons rail functions more satisfactorily in secondary service if laid in the same order as in its original service. It is also imperative that the gage side of the rail be the same and unless the rail is loaded properly it will be necessary to turn a number of rails when laying. The labor involved in turning these rails will more than offset any additional labor cost that might be involved in match-marking and loading the rail properly when released.

Where turnouts are released and are to be relaid in a secondary main or other track, a saving in cost and better conditions after the turnout is laid, can be effected if the rails are match-marked so that they can be replaced in their new location in the same order as they were released. This will also eliminate the necessity for cutting rails when installing the switch. In fact, greater relative savings can be effected by match-marking rail that is obtained from turnouts than from ordinary track.

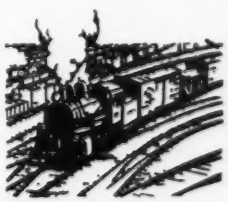
Joints on Open-Deck Bridges

What are the advantages in eliminating joints in track across open-deck steel bridges? Timber trestles? Ballast decks? What disadvantages?

Reduces Shock

By G. A. Haggander
Bridge Engineer, Chicago, Burlington & Quincy, Chicago

It seems obvious that there are both advantages and disadvantages connected with a complete elimination of joints across bridges. Among the former are elimination of the shock which occurs when wheels cross an open joint. This will have a favorable effect on both the structure supporting the track and the equipment. It will eliminate rail batter which now occurs at the joint, as well as crushing of the joint ties on open decks and puddling of the ballast on ballast-deck bridges. It will also reduce the damage to bridge ties which occurs now as a result of the creeping of the rail, by reason of which the splice bars impinge on the heads of the track spikes.



Among the disadvantages are the facts that continuously welded rail cannot be removed easily for changes which may be required in bridge structures, and the difficulty which may be encountered in loosening up the track on the bridge. This latter is especially important where, because of possible lack of lateral support on open decks, hot weather may cause buckling of the rail.

I have had no practical experience with continuous rail, for which reason the foregoing is not a conclusion based on observation. Other experience, however, leads me to believe that the advantages and disadvantages are substantially those which have been stated.

No Disadvantage

By H. Austill
Chief Engineer, Mobile & Ohio, St. Louis, Mo.

Among the advantages of eliminating joints in the track across open-deck steel bridges are a reduction in impact caused by wheels striking the rail ends at the joints, and elimination

of the trouble so often experienced by reason of rail creepage which often results in the joint bars fouling the ties or track spikes. On open-deck trestles the first of these advantages is of little consequence, but the second one is of equal importance on both steel bridges and timber trestles.

I see no advantages from a structural viewpoint of eliminating rail joints on ballasted floors, aside from the improved riding quality of the track. I see no advantage in eliminating rail joints in either case unless the rail is inadequately anchored against expansion and contraction.

Minor Repairs to Buildings

Is it practicable to have minor building repairs done by local contractors? If so, under what arrangements? If not, why? What are the advantages? The disadvantages?

It Is Practical

By L. J. Drumeller
Division Engineer, Chesapeake & Ohio, Hinton, W. Va.

It is practical and often desirable to have minor building repairs done by local contractors. In the larger communities, minor work, such as plumbing and electrical fixtures, and building repairs such as replacing window glass, etc., can be done more economically by local contractors, provided company forces capable of doing the work are not near at hand. When such forces are not close by, the cost of sending them from headquarters may be prohibitive. A good plan to follow when this can be done is to secure about three bids from reliable local contractors, accepting the lowest bid.

These suggestions should not be construed to mean that general repairs should be let by contract, or any repairs exceeding a set amount, say, $50. On the other hand, in many instances jobs amounting to less than $50 can be done more cheaply by contract, provided that the alternative is to send employees a long distance to do the work, or that train schedules involve considerable time lost while the employee is waiting for an opportunity to return to headquarters.

Saves Travel Time

By F. R. Layng
Chief Engineer, Bessemer & Lake Erie, Greenville, Pa.

It is practicable to have building repairs done by local contractors, but it is believed that these repairs should be restricted rigidly to minor items. In general they should consist of (1) repairs to down spouts, flashing and other exterior metal work; (2) minor adjustments and repairs to heating plants, sanitary facilities, etc.; (3) minor repairs to locks, door checks, office furniture, doors and windows, including the replacement of broken glass; (4) repairs to worn floors and door sills; (5) minor repairs to brick work, such as pointing; and (6) minor repairs to roofing.

This practice is desirable because of the excessive amount of travel time required to reach many outlying points from division headquarters. Owing to the curtailment of local passenger service on many lines, the time involved to reach the point where the work is to be done is generally excessive. Usually work of this character can be done in a very short time and, unless other repairs are also needed, the employee sent to do the work must wait until a train is available before he can return to headquarters. To some extent this can be overcome by allowing him to use his automobile and making a proper mileage allowance for this use of his car. On the other hand, this practice raises the question of compensation in the event an accident involves not only the public but the property of the employee.

It is believed that such repair work should be restricted to points somewhat distant from division headquarters. Doubtless there is a feeling of resentment on the part of employees if the work is done by outsiders, and unless there is a valid reason for having the work done by others it should be reserved for company men.

On some roads, where agreements with the men are specific, the practice is not possible; on others, where the agreements do not cover this point, a widespread policy of contracting such work will likely lead to demands that it be given to company forces. For this reason, great care should be used in selecting the work to be done by outsiders, and those cases that are in doubt should be resolved in favor of company forces.

Two methods of making arrangements for such work are available, these being, (1) to permit the local agent to make arrangements with the local contractor, after he has received authority from the bridge and building department to do so; and (2) to have the supervisor of bridges and buildings arrange for the repairs. In general, the amounts involved are small, so that there should be no hesitation about extending the necessary authority.

Obviously, the principal advantage is to eliminate unproductive travel time and loss of time waiting to return to headquarters. There is a real value, however, in reposing some responsibility in the agent and supervisor, thus giving them additional authority and each one a feeling that his position is one of trust. It also creates some good will in the community and creates in the minds of the local people an interest in the road and its affairs.

Among the disadvantages is the risk of creating some irritation in the minds of the regularly employed craftsmen. The whole matter must be handled with care and tact, limiting the volume of work thus contracted as well as the size of the individual jobs. It is suggested that by limiting the total expenditure on any one job to, say, $50, some check can be placed.

Attention is also called to the difficulties that arise where legislation limits either the length of the working day or the total number of hours and days a week. Sending men out on the line usually involves more than eight hours for the round trip. If such legislation is enforced, it may become absolutely necessary to contract more and more work in connection with minor repairs to buildings.

Possesses Possibilities

By Engineer of Buildings

It is not only practical, but some cases desirable, to have minor building repairs made by local contractors or, in small communities by local mechanics. While this is not a widespread practice, it possesses possibilities of developing efficiency and economy.

Making minor repairs with company forces involves too much travel time compared with the time actually required to do the work. Often a man must be sent out to determine what material will be required, then return to headquarters for it, making a second trip to apply it. In not a few instances the material is of special dimensions or type which must be ordered, thus creating further delay. Owing to the curtailment of pas-

senger schedules, it is sometimes difficult to get to an outlying point and return the same day.

If the job had been done locally the materials could have been purchased locally and in many instances the work completed before the materials could have been assembled and delivered by the railway itself. One of the chief obstacles to this practice is the desire of the railway to maintain its own forces. This attitude and opposition on the part of the men to allowing outsiders to do work which they look upon as peculiarly their own, is likely to make the change from long-established custom a slow one.

Possibly also, the thought of paying more for materials purchased locally and of adding the contractor's overhead and profit acts as a deterrent. In the majority of cases, however, these items are more than offset by the unproductive and lost time involved in getting materials on the ground and the men to and from the location of the job.

There is also the matter of assisting local tradesmen and mechanics, through purchases and employment. This builds up good will in the community. Small communities which do not have material stocks or available mechanics can be handled from larger adjoining towns, since good roads and the general use of the automobile give the contractor easy access within a radius of, say, 50 miles.

Driving Piles in Embankments

Where piles are driven to stabilize embankments, should they be tied together? Why? How should this be done?

Should Be Tied Together

By H. M. Tremaine
District Engineer, Northern Pacific, Spokane, Wash.

In general, piles driven to stabilize embankments should be tied together across the track, and at or near the top. The reason for this is that the embankment has required horizontal support in addition to that provided by its own constituent material, and these piles must act, in part at least, as a bulkhead or retaining wall. If not tied together, they are quite apt to be pressed outward at the top, thereby decreasing their effectiveness for the purpose intended.

This tying together should be done at places where piles are driven on both sides of the track or on one side only, as in the case of side-hill work. This can be done preferably with second-hand cable of the larger sizes and, in the case of side-hill work the cable may be anchored to a dead man placed on the opposite side of the track. By reason of this anchorage, the piles are not so subject to the crowding effect of loads superimposed by passing trains.

Not Effective Otherwise

By H. T. Livingston
District Maintenance Engineer, Chicago, Rock Island & Pacific, El Reno, Okla.

Stabilization of embankments by driving piles is usually resorted to on embankments six feet or more in height. In such cases, the lateral forces acting against the piles are counteracted by the resistance of the piles in bending.

In many places where this form of stabilization is required, the natural soil upon which the embankment rests is of inferior quality and permits movement of the pile point toward the track. Where no tie rod is used, the pile must be driven deep enough to insure that the tip is fixed. The pile will then act somewhat as a cantilever beam. Where a tie rod is used, the pile acts as a simple beam, the reaction at the tip being resisted by its fixation in the natural soil. The reactions at the tip and butt of a pile are practically equalized when a tie rod is used, while the pile is not so apt to be overstressed in bending.

Generally, a steel rod, not less than 1¼ in. in diameter is sufficient to hold the pile in place. This rod may be connected to the pile by either bending it around the pile or boring a hole through the pile and placing a nut on the end of the rod. This nut should rest directly against a steel plate ½ in. thick and not less than 6 in. square, placed next to the pile. Where tie rods are not used, the horizontal pressure will usually push the pile away from the track and its permanent effectiveness will be impaired.

Must Be Tied

By L. G. Byrd
Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

During my many years of experience in driving piles to stabilize embankments, we have driven them from close to the ends of the ties to as much as 18 ft. from the center of the track. In no case, however, have we obtained the desired results, unless we tied them together. On an embankment, say, from 12 to 30 ft. high, the lateral pressure of the unstable material is too great for the piling to resist unless they are given the additional support of the ties.

We have placed wales outside the piles, tying them together with second-hand ¾ or ⅞-in steel cable, allowing the cable to extend around every alternate pile. This was not altogether satisfactory, for it cost too much to get the cable through the roadbed, while the waling timbers, usually second-hand stringers, soon gave way to decay.

More recently, we have used second-hand car truss rods 1¼ to 1⅝ in. in diameter, driving the rods through the embankment and welding them to the required length as the driving progresses. If the embankment is failing on both sides of the track piles are driven opposite each other on 4 or 5-ft. centers, about 12 to 14 ft. from the center of the track. We then take a rod about 12 ft. (or more if necessary) long and bend it into a V. Loops are formed on each end to go around two adjacent piles, the opposite corresponding piles being treated in the same way. Hooks are then formed on the ends of the tie rod to engage the apex of the V, and a turnbuckle completes the assembly.

Where only one side of the embankment is failing, we drive anchor piles on the opposite side on twice the centers used for the protection piles, thus providing one anchor pile for each pair of protection piles. A loop on the end of the tie rod is placed around the anchor pile and the other end is attached to the protection piles in the manner already described.

We have, on occasion, used old rails as waling, placing them outside of the piles and welding the tie rod to them. This method is not as effective as attaching the tie rods directly to the piles, while the cost of the rails and their application to the piles is somewhat higher.

New Books

A. R. E. A. Proceedings

PROCEEDINGS of the American Railway Engineering Association for 1937, 742 pages, 6 in. by 9 in. Bound in cloth or half Morocco. Published by the Association, 59 East Van Buren street, Chicago. Price, cloth $8, half Morocco, $9.

This volume contains the complete record of the year's work of this Association, including reports of 30 of the standing and special committees, which were presented at the thirty-eighth annual convention at Chicago on March 16, 17 and 18, 1937, together with the discussions which followed their presentation. It also includes an address by Thomas H. McDonald, of the Bureau of Public Roads, on the Highway Grade Crossing Problem.

Committee reports covered a wide range of subjects, providing valuable reference material on both railway maintenance and operation. Among the total of 110 subjects considered by the convention were tentative specifications for track scales, this being a revision of the present specifications; a review of court decisions on what constitutes navigable water; an extended investigation on rail lengths in excess of 39 ft.; application of fusion welding and gas cutting to steel structures, and specifications covering these applications; tie service records, covering numerous test sections on 7 roads and tie-renewal statistics on 27 selected roads; piling for marine construction; effect of higher speeds on the labor cost of track maintenance; co-ordination of railway facilities to obtain more intensive use; fastenings for continuously welded rail; and the best practice in manufacture and handling of ties until they are in the track.

Wood-Preservers' Proceedings

PROCEEDINGS of the American Wood-Preservers' Association for 1937. 428 pages, 6 in. by 9 in. Illustrated. Bound in cloth. Published by the Association, 1427 Eye street, N.W., Washington, D.C. Price $6.

Thirty-two papers and committee reports, together with the discussions which followed their presentation are contained in this volume of the proceedings of the thirty-third annual convention of the association. While some of these are technical and of interest primarily only to those in the wood-preserving industry, the remainder cover a wide range of subjects relating to the treatment of wood to make it resistant to decay and attack by insects or to render it fireproof.

In addition to those of a purely technical character, other reports of special interest are those on service records of ties, marine piling and fence posts; an extensive addition to the bibliography on the fireproofing of wood, which was published in the 1936 Proceedings; and revision of the specifications for the treatment of ties, timber, lumber, piles and posts.

Papers of particular interest to maintenance officers are those on the History of the Lake Pontchartrain Trestle, Future Research on Marine Borers, Twenty-Five Years' Experience with Ties and Timber from the User's Standpoint, Findings of the Southern Forest Survey, and An International Termite Exposure Test—Eighth Progress Report. Other papers containing much information with respect to preservatives and treatment are Quality and Toxicity of Creosote Extracted from Red Oak Ties After Long Periods of Service, with Special Reference to the Decay Resistance of Treated Wood; Treatment of Yellow Pine Lumber with Zinc Chloride and Zinc Chloride-Sodium Bichromate; and Temperatures Necessary to Kill Fungi in Wood.

The statistical section contains the twenty-eighth annual report, for 1936, of the quantities of wood treated and preservatives used in the United States, by R. K. Helphenstine, Jr., of the Forest Service, United States Department of Agriculture, together with a list of all of the wood-preserving plants in the United States, Canada and Mexico.

What Our Readers Think

French Drains in India

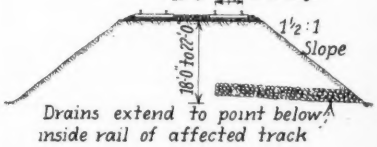
Nagpur, India.

TO THE EDITOR:

I have read with interest the discussion on Constructing French Drains which appeared in the What's the Answer Department of *Railway Engineering and Maintenance* for May, 1937.

In India we are faced with the problem presented by the formation of water pockets in high embankments made of black cotton soil, and I have found that such water pockets can be cured by installing French drains, provided the drain is long enough to extend into the embankment to a point about vertically under the inner rail of the affected track. We use drains 4 ft. wide and place them at intervals of 20 to 25 ft., with the outlet at the toe of the embankment and with the bottom of the drain properly graded. As indicated in the accompanying drawing, the height of the embankments affected by such water pockets is generally from 18 ft. to 22 ft., and the pockets usually affect only one track.

These drains must be constructed under traffic and, as the black cotton soil of which the embankments are made is very unstable and the trenches are of sufficient length to affect both tracks, I find it difficult and expensive to excavate for the drains. Moreover, the same difficulty and expense reoccurs each time the drains are

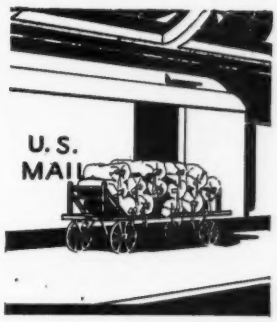


Sketch Illustrating Mr. Smith's Method of Installing French Drains

opened and cleaned. Perhaps some of your readers, in coping with situations similar to that described above, have developed satisfactory low-cost methods of excavating such trenches in high embankments under traffic and of re-opening them for cleaning. If so I shall appreciate receiving from them details concerning the methods employed.

W. R. SMITH,
Divisional Engineer
Great Indian Peninsula Railway
Nagpur, C.P., India

News of the Month



New Film to Depict History of Express Service

A feature moving picture, entitled "Wells Fargo," which depicts the history of the express business and participating carriers from 1844 to 1869, is now in the process of production by Paramount Pictures. The picture is being directed by Frank Lloyd, and includes in its cast such players as Joel McCrea, Frances Dee, Ralph Morgan and Bob Burns.

Railroad Unions to Ask Unemployment Insurance

A bill for presentation in the next session of Congress, providing unemployment insurance for railroad workers, is being drafted by the Railway Labor Executives' Association, following a meeting in Chicago on August 13. The proposed bill would create a pool from which jobless railroad men would be paid not more than $320 a year. Payments would be half the recipient's salary up to $80 a month, with a minimum allowance of $7.50 a week. The railroads would pay all the cost with a 3 per cent payroll tax, estimated to provide $66,000,000 yearly.

First-Class Round Trip Rate Raised to 2¼ Cents

Effective October 16, the Western and Southeastern lines will increase the rate for first-class round trip fares from 2 cents to 2¼ cents a mile. This move is being made to equalize the differentials between various basic passenger rates. Under the prevailing rates the round-trip coach rate of 1.8 cents a mile is a reduction of 10 per cent under the one-way rate of 2 cents, while the round-trip first-class rate of 2 cents is 33-1/3 per cent less than the first-class one-way rate of 3 cents. The new rate of 2¼ cents will be a reduction of 25 per cent under the first-class one way rate.

Rogers Appointed to Membership on I.C.C.

John L. Rogers, at present chief of the Bureau of Motor Carriers of the Interstate Commerce Commission, has been appointed by President Roosevelt to membership on the commission, to succeed Hugh M. Tate. Mr. Tate's term as a member of the commission expired at the beginning of the year, but he has continued to serve under a recent amendment to the Interstate Commerce Act, which provides that members of the commission may serve until their successor has qualified for office. Previously the president had nominated for a new term as a member of the commission, Joseph B. Eastman, whose previous term also expired at the beginning of the year. The Senate has confirmed both appointments.

Research Division Created by A.A.R.

A Division of Engineering Research, which will expand and co-ordinate research work now being carried on by the railroads of the country in-so-far as it affects the physical properties, has been established by the Association of American Railroads. The new division will have jurisdiction over all research relating to cars, locomotives, track structures, buildings, electrical, shop and maintenance of way equipment and the materials and supplies used in connection therewith. Not only will it deal with all mechanical facilities, but also with metallurgical and physical problems, as well as fuel, water, paints and other materials and supplies. The new division will absorb the work now being performed by the Division of Equipment Research which was organized several years ago. L. W. Wallace, who has been head of the Division of Equipment Research, has been appointed Director of the Division of Engineering Research and G. M. Magee, assistant engineer, Kansas City Southern, has been appointed assistant director.

Mexico Now Building 1000 Miles of New Lines

With work now being carried forward on 1,000 miles of new lines, construction activity in Mexico has attained a new high level. Involved in the present program are five different projects, costing a total of approximately $42,000,000, which are being constructed by the Secretariat of Communications and Public Works through the Department of Railroads, Traffic and Tariffs. By far the largest of the projects is that known as the Southeastern line which is being constructed to provide a connection between the government railways in the state of Yucatan and those of the remainder of the country. Starting at Puerto Mexico, Vera Cruz, this line will extend easterly and somewhat southerly, across the states of Vera Cruz, Tabasco and Chiapas, and thence northeasterly across the state of Campeche to the city of Campeche, where it will join with the United Railways of Yucatan. This line will be approximately 475 miles long and will cost about $23,000,000. About 87 miles of this line have been graded, 35 miles of rail have been laid and all but 25 miles has been surveyed.

Rockets Soon to Enter Service on Rock Island

The first two of the six new streamlined, light-weight, high-speed trains, known as "Rockets," to be purchased by the Chicago, Rock Island & Pacific have been delivered to the railroad and are expected to be placed in service shortly between Kansas City, Mo., and the Twin Cities. Four of the trains, including the two which have been delivered, consist of three partially-articulated, stainless steel body units; the remaining two have four body units. Each of the six trains will be hauled by a 1200-hp. Diesel-electric locomotive capable of making 117 miles an hour. They are daylight trains with no sleeping accommodations, are air-conditioned throughout and have automatic telephone communication between the cab and the observation cab.

National of Mexico Taken Over by State

As a result of a recently-issued presidential decre, the National Railways of Mexico have ceased to become a private corporation and are completely nationalized and taken over by the state. Previously ownership of these lines was vested in the government as the majority stockholder and in numerous private stockholders, who will be reimbursed by the government after the secretariat of communications and public works determines the "amount of indemnity chargeable to the federal government." The national railway system will be operated by a new autonomous department of railroads which will "be operated under the direct supervision of the federal government, although with sufficient independence and authority to execute its proper functions."

Agree on Pay Boost to Non-Operating Employees

Non-operating employees of the railroads, including those in the maintenance of way department, will receive a pay increase of 5 cents an hour, retroactive to August 1, as the result of an agreement reached between representatives of the railroads and of the fourteen non-operating brotherhoods at Washington, on August 4. The agreement was later ratified by the general chairmen of the non-operating brotherhoods at a meeting in Chicago.

Representatives of the railroads, following 11 days of conferences at Chicago with representatives of the "Big Five" train and engine service brotherhoods, refused to agree to the demand of the unions for a 20 per cent increase in pay for their members. Following the breakdown of these negotiations the National Mediation Board offered to intervene and to help the two parties reach a compromise in the controversy, which offer was accepted by both sides. Mediation proceedings were started at Chicago on Saturday, August 28, before Dr. William M. Leiserson.

Personal Mention

General

C. I. Ingram has been appointed inspector of work equipment on the Coast lines of the Atchison, Topeka & Santa Fe, with headquarters at San Bernardino, Cal.

A. C. Bradley, division engineer of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has been promoted to assistant superintendent at Minneapolis, Minn.

William K. Tate, assistant to the vice-president and traffic manager of the Nashville, Chattanooga & St. Louis, and formerly an assistant division engineer on this road, has been appointed to the newly-created position of assistant to the president of this company, with headquarters as before at Nashville, Tenn. Mr. Tate

William K. Tate

was born on January 13, 1898, at Tyler, Tex., and was educated at Vanderbilt university, Nashville. He entered the service of the N. C. & St. L., on March 13, 1917, as a draftsman in the engineering department, later serving as instrumentman and topographer on a survey party. On January 1, 1918, he was appointed assistant division engineer on the Huntsville division, with headquarters at Tullahoma, Tenn., holding this position until October 1, 1918, when he volunteered for service in the United States Army, serving at the Officers Training Camp at Fort Monroe, Va. On his discharge from the army in 1918, he returned to his former position on the N. C. & St. L. at Tullahoma, where he served until March 16, 1929, when he was appointed industrial engineer in the industrial and public relations division of the traffic department, with headquarters at Nashville. On January 1, 1935, he was placed in charge of the industrial and public relations division, with the same title, in which capacity he served until March, 1936, when he was appointed assistant to the vice-president and traffic manager.

H. O. Wagner, division engineer of the Plains division of the Western lines of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has been appointed trainmaster, with headquarters at Wellington, Kan., to succeed **T. A. Blair,** whose appointment as district engineer of the Northern district of the Western lines, with headquarters at La Junta, Colo., is noted elsewhere in these columns.

Carl R. Gray, Jr., vice-president and general manager of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn., and at one time principal engineer of construction of the Oregon Electric and the Spokane, Portland & Seattle, has been elected executive vice-president in charge of operation and traffic of the Omaha, with headquarters at the same point.

Engineering

D. A. Kuebler has been appointed division engineer of the Northern division of the Kansas City Southern with headquarters at Pittsburg, Kan., to succeed **W. J. Lank,** assigned to other duties.

H. Austill, bridge engineer of the Mobile & Ohio, has been promoted to chief engineer with headquarters as before at St. Louis, Mo., to succeed **Bernard A. Wood,** whose death is noted elsewhere in these columns.

C. J. Code, division engineer of the Panhandle division of the Pennsylvania has been appointed assistant to the chief engineer maintenance of way of the Central region, with headquarters as before at Pittsburgh, Pa.

George A. Belden, architect in the chief engineer's office of the Central of Georgia, has been promoted to engineer of bridges and buildings at Savannah, Ga., succeeding **J. B. Maddock,** who has retired from active service, effective August 1, after more than 34 years of service in the engineering department of that road.

T. A. Blair, trainmaster on the Atchison, Topeka & Santa Fe at Wellington, Kan., has been appointed district engineer of the Northern district of the Western lines, with headquarters at La Junta, Colo., succeeding **L. G. Harris,** who has been appointed division engineer of the Slaton division of the Panhandle & Santa Fe, with headquarters at Slaton, Tex. Mr. Harris replaces **J. B. Raymond,** who has been transferred to the Plains division of the Western lines, with headquarters at Amarillo, Tex., to replace **H. O. Wagner.** As noted elsewhere in these columns Mr. Wagner has been appointed trainmaster with headquarters at Wellington, Kan., to succeed Mr. Blair.

W. R. Parvin, division engineer of the Chicago Terminal division, with headquarters at Chicago, has been transferred to the Middle division, with headquarters at Altoona, Pa., and has been succeeded by **Joseph M. Fox,** who has been on special duty in the offices of the chief electrical engineer and the chief engineer at Philadelphia, Pa. Mr. Parvin succeeds **R. W. Sheffer,** who has been transferred to the Pittsburgh division, at Pittsburgh, Pa., where he takes the place of **H. H. Pevler,** who has been assigned special duties in the office of the chief engineer at Philadelphia.

Mason Rector, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., has been promoted to district maintenance engineer, with headquarters at Kansas City, Mo., to succeed **W. E. Heimerdinger,** who has been transferred to Des Moines, Iowa, to replace **L. J. Hughes,** who has been appointed division engineer with headquarters at Des Moines to relieve **A. C. Bradley,** whose appointment as assistant superintendent is noted elsewhere in these columns. **B. Matheis,** bridge supervisor of the First district of the Rock Island, has been appointed acting division engineer of the Southern division, with headquarters at Ft. Worth, Tex., succeeding **S. L. McClanahan,** who has been transferred to the Oklahoma division with headquarters at El Reno, Okla., to replace **C. A. Richards,** who has been granted a leave of absence.

C. E. Miller, supervisor of scales and work equipment of the Chicago & North Western, with headquarters at Chicago, has been promoted to assistant engineer of maintenance, with the same headquarters, to succeed **J. A. S. Redfield,** who has retired after 39 years of service with this company.

Mr. Redfield was born on December 29, 1875, at Santa Barbara, Cal., and was educated at Rensselaer Polytechnic Institute, being graduated in 1898. He entered railway service on July 10 of the same year as a rodman on the Chicago & North Western, serving in this capacity and as an instrumentman, assistant engineer and resident engineer on maintenance, location and construction until 1908. In that year he was promoted to division engineer and served in this capacity on various divisions until 1920, when he was further promoted to assistant engineer of maintenance, with headquarters at Omaha, Neb. Subsequently Mr. Redfield was transferred to Chicago, where he remained until his retirement.

S. C. Jump, whose appointment as division engineer of the Vicksburg division of the Illinois Central, with headquarters at Vicksburg, Miss., was reported in the July issue, has been identified with this company almost continuously for 32 years. He was born in 1881 and first entered the service of the Illinois Central on March 8, 1905, as an engineer apprentice on the Springfield division. For four years Mr. Jump served in this capacity and as a chainman and rodman at various points. On August 21, 1909, he was promoted to instrumentman on the Memphis division and on June 3, 1913, he was made field engineer at the Nonconnah (Memphis, Tenn.) terminal, later serving as resident engineer at Swan Lake, Miss. On September 10, 1914, Mr. Jump was appointed assistant engineer, holding this position until May 13, 1917, when he entered military service. On his return to service with the Illinois Central on February 11, 1919, he was appointed assistant engineer in the valuation department, later holding the same position at various points until January 1, 1921, except for a

short period during the fall and winter of 1920 when he was on a leave of absence. On February 20, 1923, Mr. Jump was appointed supervisor of track and two years later he was made roadmaster of the East St. Louis Terminal division, later being transferred to the former Wisconsin division. On December 1, 1929, he was advanced to division engineer of the same division, being appointed road supervisor two years later. On April 1, 1936, he was made acting division engineer of the Springfield division, being reappointed road supervisor on October 1 of the same year. On January 1, 1937, he was made acting supervisor of trains and track at Mattoon, Ill., and from February 1 until his recent appointment he held the position of supervisor of trains and track at Clinton, Ill.

Track

Marvin R. Smith has been appointed roadmaster on the Northern Pacific with headquarters at Jamestown, N.D., succeeding **John Kovar,** who has retired on pension.

P. M. Loftus, general foreman in the track department of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed acting roadmaster, with headquarters at Wausau, Wis., to succeed **E. Callahan,** who has retired.

Dee Barksdale has been appointed roadmaster on the Laredo district of the International-Great Northern, with headquarters at San Antonio, Tex., to succeed **T. J. Hawkes,** who has retired, effective August 1.

L. B. Edmonson, a track foreman on the Illinois Central, has been promoted to road supervisor with headquarters at Vicksburg, Miss., to succeed **K. S. Sale,** who has been transferred with the same headquarters, to succeed **H. D. Cunningham,** who has retired.

A. L. Ray, an instrumentman in the office of the assistant engineer of the Detroit division of the Grand Trunk Western, has been appointed supervisor of track with headquarters at Detroit, Mich., to succeed **H. Plowman,** who has retired after 50 years of service.

L. V. Lienhard, who has been acting division engineer of the Western division of the Atchison, Topeka & Santa Fe, with headquarters at Dodge City, Kan., during the absence of **R. G. Whyman,** has returned to the position of roadmaster with headquarters at Pueblo, Colo.

O. L. Malone has been appointed roadmaster on the Pensacola subdivision of the St. Louis-San Francisco, with headquarters at Atmore, Ala., succeeding **Dorsey Greer,** who has been transferred to the Lebanon subdivision, with headquarters at Newburg, Mo., to succeed **S. Bell,** resigned.

W. Shallenberg, a section foreman on the Indiana division of the Cleveland, Cincinnati, Chicago & St. Louis, has been promoted to track supervisor on the same division with headquarters at Greensberg, Ind., to succeed **A. E. McCullough,** who has been transferred to the Ohio division, with headquarters at Galion, Ohio, to replace **P. F. Sullivan,** who has been granted a leave of absence.

John Roszak has been appointed roadmaster on Sub-division No. 1 of the Sioux City division of the Chicago & North Western, with headquarters at Wall Lake, Iowa, to succeed **E. A. White,** who has been transfererd to Sub-division No. 3 of the Northern Iowa division, with headquarters at Belle Plaine, Iowa, where he replaces **Joseph Tehan,** who has retired after more than 53 years service with this company.

G. A. Gunderson, a track supervisor on the Chicago, Rock Island & Pacific, has been appointed roadmaster on the Oklahoma division, with headquarters at El Reno, Okla., succeeding **Mason Rector,** whose appointment as district maintenance engineer is noted elsewhere in these columns. **A. Stamos,** also a track supervisor, has been promoted to roadmaster with headquarters at Sibley, Iowa, to succeed **P. J. Desmond,** who has retired. **C. J. Gardner,** roadmaster with headquarters at Dalhart, Tex., has been transferred to El Reno, to replace **C. M. Webb,** who in turn has been transferred to Dalhart.

Frank I. Hahs, who has been appointed roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Rincon, N.M., as reported in the August issue, was born on October 1, 1898, at Pueblo, Colo. After a public school education he entered railway service on March 16, 1922, with the Santa Fe, as a time-keeper on a rail-laying gang. On August 1 of the same year he was promoted to section foreman and in May, 1923, he was placed in charge of a rail-laying gang. On September 1 of the same year he was sent to Colorado Springs, Colo., as a yard foreman and for seven or eight years thereafter he served as a track foreman during the winter months and as an extra gang foreman on rail-laying work during the working season. His promotion to roadmaster became effective on June 15.

F. C. Hajek, assistant roadmaster on the Chicago & North Western, with headquarters at Boone, Iowa, has been promoted to roadmaster on Sub-division No. 2 of the Sioux City division, with headquarters at Wall Lake, Iowa, succeeding **R. E. Meyer,** who has been transferred to Sub-division No. 4 of the Northern Iowa division, with headquarters at Mason City, Iowa, to succeed **F. Eggleston,** who has retired. **J. T. Peabody,** assistant roadmaster on the Wisconsin division, has been appointed roadmaster on Sub-division No. 8 of the Dakota division, with headquarters at Tracy, Minn., to succeed **G. K. Sterling,** who has been transferred to Sub-division No. 2 of the northern Iowa division, with headquarters at Eagle Grove, Iowa, to replace **T. R. Woods,** who has retired.

J. H. Gibbs, who has been appointed roadmaster on the Missouri Pacific, with headquarters at Wichita, Kan., as reported in the August issue, was born on December 29, 1889, at Knoxville, Iowa. After a public school education he continued his studies through the International Correspondence Schools and the Railway Educational Bureau. Mr. Gibbs entered railway service on April 13, 1912, as a section laborer with the Missouri Pacific, serving in this capacity until 1915, when he was advanced to section foreman. From March, 1917, to August, 1918, he served with the Michigan Central and the New York Central as yard foreman and extra gang foreman at Detroit, Mich., returning to the Missouri Pacific at the end of this period as a section foreman. He served in this capacity and as yard foreman until his recent promotion to roadmaster.

John W. DeMoyer, Jr., assistant supervisor of track on the Philadelphia division of the Reading, with headquarters at West Trenton, N.J., has been promoted to supervisor on the same division, with headquarters at Reading Terminal, Philadelphia, Pa. Mr. DeMoyer was born on February 16, 1905, at Pottsville, Pa., and was educated at Lehigh University, from which he was gradauted in 1927. Immediately following graduation, he entered the service of the Reading as a transitman in the chief engineer's office. On April 25, 1928, he was promoted to acting assistant supervisor on the W. & C. division, at Reading, Pa. On June 11, 1928, Mr. DeMoyer was appointed assistant supervisor, with office duties, on the Shamokin division, at Tamaqua, Pa., and on May 1, 1932, he was assigned to field work with the same title. Later he held this position at St. Nicholas, Pa., and at Pottsville, on the Shamokin division, and went to West Trenton, N.J., on October 1, 1935, where he was located at the time of his recent promotion to supervisor at Philadelphia.

George Talbot, who has been appointed roadmaster on the Canadian Pacific, with headquarters at Red Deer, Atla., as reported in the July issue, was born on February 20, 1892, in Manitoba. He first entered railway service on April 6, 1911, with the Canadian Pacific, being appointed a chainman in 1913 and a rodman in 1914. In the following year he left this company to go with the Canadian National as a chainman. From 1916 to 1919, Mr. Talbot served with the Canadian Army, returning to railroad service with the Canadian Pacific at the end of this period as a rodman. In 1920 he was made an instrumentman and in 1921 he became foreman of a fence gang. From 1922 to September 15, 1923, he served as a section foreman and as assistant extra gang foreman. At the end of this period he was made a general foreman, which position he held for several years, then returning to the position of section foreman. In December, 1934, Mr. Talbot was promoted to roadmaster, serving in this capacity and as relieving roadmaster until February, 1937, when he was made acting roadmaster at Red Deer, the position he was holding at the time of his recent appointment as roadmaster.

Charles B. Wilkes, who has been appointed supervisor of track on the Chicago & Eastern Illinois, with headquarters at Villa Grove, Ill., as reported in the August issue, was born on August 26, 1885, at Alton, Ind. He first entered railway service in October, 1902, as a laborer on

the Southern at Bellmont, Ill. In October, 1904, he was advanced to track foreman, holding this position until July, 1909, when he left this company to go with the Cleveland, Cincinnati, Chicago & St. Louis (Big Four) as a brakeman, later serving in the same capacity with the Chicago, Peoria & St. Louis. On February 25, 1912, he returned to the Big Four as a track foreman at Vincennes, Ind., holding this position until June 1 of the same year, when he went with the Chicago & Eastern Illinois as a track foreman at Vincennes. On January 9, 1926, he was promoted to assistant supervisor, holding this position until August 31, 1927, when, the position of assistant supervisor having been abolished, he was returned to the position of track foreman at Vincennes. He was holding this position at the time of his recent appointment as supervisor of track at Villa Grove, effective July 15.

Bridge and Building

James J. LaBat, assistant foreman of bridges and buildings on the Missouri Pacific at Wynne, Ark., has been promoted to assistant bridge and building supervisor, with headquarters at Poplar Bluff, Mo.

S. P. Perkins, district motor car inspector on the Chicago, Rock Island & Pacific, with headquarters at Herington, Kan., has been promoted to master carpenter with headquarters at Cedar Rapids, Iowa, to replace **F. D. Whaley,** who has retired.

Oscar Griffin, a bridge and building foreman on the Illinois division of the Cleveland, Cincinnati, Chicago & St. Louis, has been promoted to bridge and building supervisor on the same division, with headquarters at Washington, Ind., to succeed **Dan Cline,** who has retired.

Angel Monson, assistant supervisor of bridges and buildings on the Yellowstone division of the Northern Pacific, has been promoted to bridge and building supervisor, with headquarters at Glendive, Mont., to succeed **Andrew Hanson,** who has been transferred to Missoula, Mont., where he replaces **W. M. Bradford,** who has retired on pension.

C. M. Dorsey, who has been appointed master carpenter on the Denver & Rio Grande Western, with headquarters at Alamosa, Colo., as reported in the July issue, was born on July 15, 1885, at Glendale, Ind. Mr. Dorsey has worked a total of about 32 years with various railroads. He first entered railway service with the Baltimore & Ohio in 1903, with which company he worked as a painter until 1911, when he went to Colorado to enter the service of the Moffet line (Denver & Salt Lake), where he was engaged on the construction of snow sheds at Corona Pass. In 1912 Mr. Dorsey entered the employ of the Phenix Construction Company and on June 17, 1914, he went with the Denver & Rio Grande Western, where he was working as a carpenter until May 15, 1915, when he was advanced to bridge and building foreman. He was holding the latter position at the time of his recent appointment as master carpenter.

Elmer R. Nelson, whose appointment as supervisor of bridges and buildings on the Chicago & North Western,, with headquarters at Huron, S.D., was reported in the August issue, was born on November 20, 1888, at Huron. Following a public school and correspondence school education he entered railway service in July, 1911, as a bridge and building foreman on the Grand Trunk Pacific (now part of the Canadian National) at Regina, Sask. From 1915 until 1932, he served with various construction firms as carpenter, foreman and superintendent. On August 23, 1932, he entered the service of the North Western as a bridge carpenter, being promoted to bridge and building foreman on October 17, 1933. His further advancement to the position of supervisor of bridges and buildings at Huron became effective on July 1.

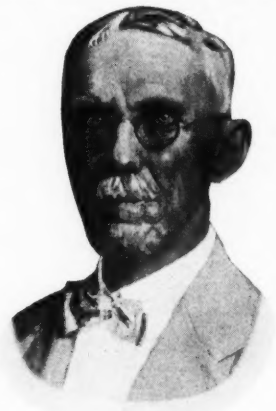
Obituary

Thomas J. F. King, assistant district engineer on the Canadian National, with headquarters at Quebec, Que., died in a hospital on August 17, after several months illness, at the age of 56 years.

Frank Ivers, general roadmaster on the Union Pacific, with headquarters at Spokane, Wash., whose death on July 10 was reported in the August issue, had been in railroad service for about 17 years. He was born on September 5, 1881, at Hickman, Neb., and first entered railway service with the Denver & Rio Grande Western in August, 1920, as a roadmaster at Salida, Colo. Four years later he left this company to go with the Colorado & Wyoming as assistant superintendent at Sunrise, Wyo. After about six months in the latter capacity Mr. Ivers entered the service of the Denver & Salt Lake as roadmaster at Tabernacle, Colo., leaving this company in July, 1925, to go with the Oregon Short Line (part of the Union Pacific), where he served as an extra gang and steel gang foreman. In December, 1928, he was promoted to roadmaster at Dillon, Mont., and on June 29 he was further advanced to general roadmaster of the Idaho division, returning to the position of roadmaster on the same division in August, 1931. In July, 1933, he was appointed general roadmaster on the Oregon-Washington R.R. & Navigation Company (also part of the Union Pacific) at Pendleton, Ore., being transferred to Spokane in December, 1935.

Bernard A. Wood, who retired about a month ago as chief engineer of the Mobile & Ohio, with headquarters at St. Louis, Mo., died in a hospital at that point on August 18 of heart disease. Mr. Wood had been connected with the Mobile & Ohio for 40 years. He was born on February 14, 1867, at Tuscaloosa, Ala., and received his higher education at the University of Alabama. He first entered railway service in July, 1888, as a resident engineer on the Louisville & Nashville. In the following year he was appointed assistant engineer, which position he held until 1891, when he resigned to become assistant engineer on a survey of the international boundary between the United States and Mexico. During 1895 he served on the Nicaragua Canal Board and in the following year he engaged in mining engineering work in Colorado. In 1897 Mr. Wood entered the employ of the Mobile & Ohio as an assistant engineer, later serving as resident engineer. He had been chief engineer of this road since 1910.

Hunter McDonald, who retired on November 1, 1931, as chief engineer of the Nashville, Chattanooga & St. Louis, died on August 24 at the age of 77 years after an illness of several weeks. Mr. McDonald was born on June 12, 1860, at Winchester, Va., and studied engineering for a year at Washington & Lee University, Columbia, Tenn. He entered railway service in August, 1879, as an assistant engineer on the Louisville & Nashville, remaining with this company until December of the same year, when he left to join the engineering staff of the Nashville, Chattanooga & St. Louis. With this company he engaged in various capacities on location, construction and maintenance



Hunter McDonald

work for the next 10 years. In 1889 he was appointed superintendent of the Huntsville, Fayetteville & Columbia division, which position he held until 1891, when he was appointed resident engineer of the Western Atlantic (now part of the N.C. & St. L.). In 1892, Mr. McDonald was promoted to chief engineer of the N.C. & St. L., which position he held continuously until his retirement in 1931. From 1918 to 1920, during federal control of the railroads, Mr. McDonald was also chief engineer of the Tennessee Central and the Birmingham & North Western. He took an active interest in the work of various engineering organizations, having been president of the American Railway Engineering Association in 1904-05, and of the American Society of Civil Engineers in 1914.

Russell C. Watkins, vice-president and general manager of the Louisiana lines of the Southern Pacific, who devoted many years of his career to maintenance of way and engineering work, died in New Orleans, La., on July 28. He was born on September 18, 1874, in Lowndes county, Ala., and received his education at the Agricultural and Mining College of Texas. He entered railway service on September 18, 1895, as a section laborer and track-walker on the Galveston, Har-

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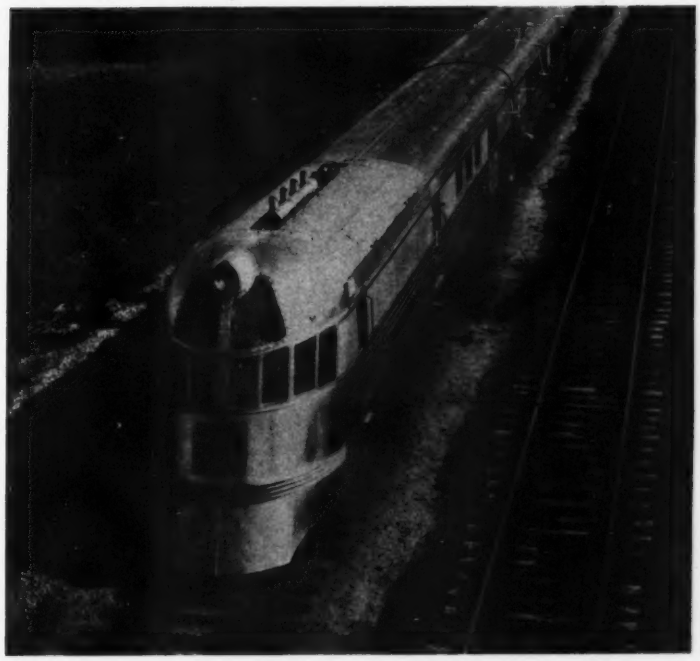
CONVENTION



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risburg & San Antonio (part of the Southern Pacific). In April, 1896, he was transferred to the engineering department as a rodman and served in this capacity until November, 1896, when he returned to the track department as a student foreman in the Houston yards of the Texas & New Orleans (also part of the Southern Pacific). In February, 1897, he received a leave of absence from the Southern Pacific to become engineer for the Juarez Construction Company in Mexico and in that capacity had charge of the construction of a part of the line of the Rio Grande, Sierra Madre & Pacific in the state of Chihuahua. At the end of his leave of absence, Mr. Watkins assumed charge of the grade revision work on the G.H. & S.A., in the Rio Grande valley near El Paso, Tex., and was subsequently transferred to the Louisiana lines as engineer in charge of the construction on branch lines. He was promoted to acting division engineer at San Antonio, Tex., in 1900, and after serving in this capacity for several months was appointed office engineer, with headquarters at Houston, Tex. He was promoted to right-of-way agent of the Louisiana lines on January 1, 1904, which position he held until January 1, 1913, when he was appointed acting division superintendent of the Houston division, with headquarters at San Antonio, Tex., being promoted to division superintendent on July 1 of the same year. During the period of federal control he served as corporate maintenance engineer on the Louisiana lines and upon the termination of federal control continued in that capacity, preparing the claims against the director general of railroads for the Southern Pacific. He continued in this capacity until March 1, 1923, when he was promoted to vice-president and general manager.

Association News

International Railway Maintenance Club

The feature of the next meeting of the club, which will be held at Toronto, Ont., Canada, on the afternoon of September 2, will be a discussion of abrasives and grinding wheels used in maintenance of work. The meeting will follow directly after luncheon at 12:30 p.m., Eastern Standard Time, at the Hotel Royal York, and will be addressed by B. H. Work, sales engineer, and Harry Jones, specialists on abrasives of the Carborundum Company. Mr. Work will discuss the general action of abrasives, while Mr. Jones will talk about grinding wheels as applied specifically to maintenance of way work. The talks will be supplemented by motion pictures.

Track Supply Association

Sixty-four manufacturers of track supplies have reserved 75 spaces to date in the annual exhibit of the Track Supply Association, which will be held at the Hotel Stevens, Chicago, on September 13-16 coincident with the convention of the Roadmasters and Maintenance of Way Association. Those companies which have taken membership since the August issue went to press are as follows:

Crown Rock Sales Company, Chicago
National Refining Company, Cleveland, Ohio
Positive Rail Anchor Company, Marion, Ind.
Pettibone Mulliken Corp., Chicago
Railway Purchases and Stores, Chicago
S. E. Rawls Company, Streator, Ill.
Woolery Machine Company, Minneapolis, Minn.

Further applications for membership and space should be addressed to Dan J. Higgins, secretary-treasurer of the association, 332 South Michigan avenue, Chicago.

Bridge and Building Supply Men's Association

A total of 32 companies have already arranged to exhibit during the convention of the American Railway Bridge and Building Association at the Hotel Stevens, Chicago, on October 19-21. The exhibit and convention will be transferred from the Tower to the lower floor of the hotel, where larger space is available. A number of additional companies are therefore arranging to exhibit this year. Applications should be sent to W. S. Carlisle, secretary, 900 West 18th Street, Chicago.

The companies that have arranged for exhibits to date, in addition to the 27 listed in the August issue, are as follows:

Arrow Tools, Inc., Chicago
Homelite Corporation, Portchester, N.Y.
Ingot Iron Railway Products Company, Middletown, N.Y.
W. W. Patterson Company, Pittsburgh, Pa.
U. S. Wind Engine & Pump Company, Batavia, Ill.

American Railway Engineering Association

Bulletin 396, containing several monographs and other material, will be mailed to the members early in September. Among important features of this bulletin are: Statistics on the crosstie renewals of individual railways in 1936; the announcement of the creation of a division of research of the Association of American Railroads, as reported elsewhere in these pages; a monograph on the Buckling Tendency of the Compression Flanges of Plate Girders, by B. R. Leffler, bridge engineer of the New York Central, Lines West; a Digest of the Reports of the International Railway Congress on Foreign Freight Yards and High-Speed Tracks, by E. E. R. Tratman, consulting engineer; a Petrographic Study of the Bond Between Brick and Mortar, by H. R. Staley, research assistant, Massachusetts Institute of Technology; and a Record of Flood Damage to Equipment, by J. M. Trissal, electrical engineer, fixed property, Illinois Central.

While only a few committees held meetings during August, nine committees have already scheduled meetings for September, of which five will be held in Chicago during the convention of the Roadmasters and Maintenance of Way Association. These committees, with the dates of their meetings are as follows: Track, on September 14; Highways, on September 14; Rail, on September 15; Economics of Railway Location, on September 15; and Maintenance of Way Work Equipment, on September 14 and 15. In addition the Committee on Standardization will meet at Chicago on September 13, and the Committee on Roadway at the same place on September 28. Meetings at other places include those of the Committee on Buildings, at Toronto, Ont., on September 8 and 9, and the Committee on Wood Bridges and Trestles, at Urbana, Ill., on September 14. The Board of Direction will hold a meeting at Chicago on September 14.

Because of the demand for copies of chapters of the Manual of Recommended Practice representing the work of individual committees by persons who would have little occasion to use the entire Manual, the Board of Direction has authorized the binding of the chapters in separate pamphlets, which are now offered for sale at prices ranging from 25 cents to $1.50, depending on the material included.

Bridge and Building Association

The program is now practically completed for the 44th annual convention, which will be held at the Hotel Stevens, Chicago, on October 19-21. Secretary C. A. Lichty also has on hand completed reports from four of the committees, while three others are in the final stages of completion. The program is as follows:

Tuesday, October 19

Morning Session—10 A.M.

Invocation
Address by Harry G. Taylor, chairman, Western Association of Railway Executives, Chicago
Greetings from the American Railway Engineering Association by J. C. Irwin, president (valuation engineer, B. & A., Boston, Mass.)
Greetings from the Roadmasters and Maintenance of Way Association by A. H. Peterson, vice-president (roadmaster C.M.St.P. & P., Chicago)
Address by President E. C. Neville, (bridge and building master, C. N., Toronto, Ont.)
Appointment of special committees
Report of Committee on Rebuilding our Bridge and Building Organization to Meet the Demands of the Present Day, Armstrong Chinn, chairman (chief engineer, Alton, Chicago)

Afternoon Session—2 P.M.

Report of Committee on The Maintenance of Movable Bridge Spans, J. L. Vogel, chairman (Bridge Engineer, D.L. & W., Hoboken, N.J.)
Address on Some Reasons Why Bridge and Building Men Are Injured; by S. H. Osborne, assistant to executive vice-president, U. P., Omaha, Neb.
Report of Committee on Taking Up the Deferred Maintenance in Painting, T. P. Soule, chairman (general supervisor of bridges and buildings, N. Y. C., New York)
Adjournment to visit exhibit of the Bridge and Building Supply Men's Association

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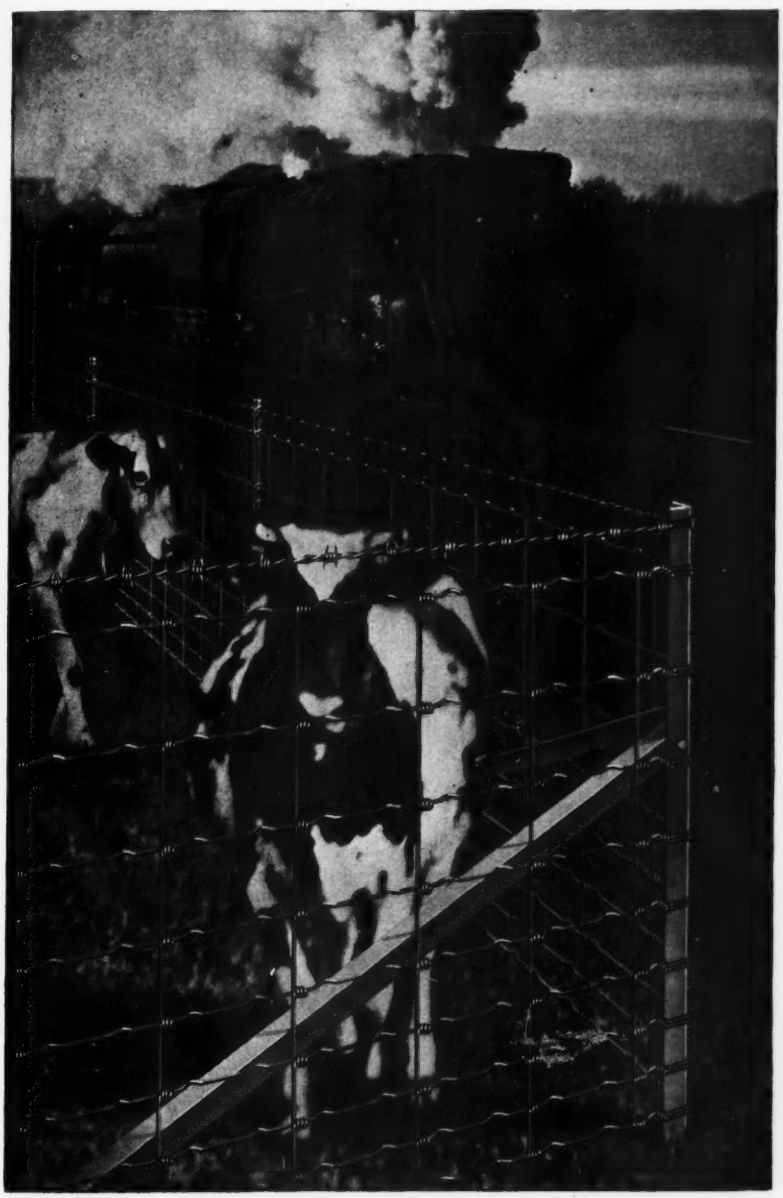

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Tuesday Evening—7:30 P.M.

Address on The Construction of the San Francisco-Oakland Bay Bridge, supplemented by moving pictures; by C. F. Goodrich, chief engineer, American Bridge Co., Pittsburgh, Pa.

Wednesday, October 20

Morning Session—9:30 A.M.

Report of Committee on Recent Developments in the Construction of Timber Trestles, W. S. Lacher, chairman (managing editor, *Railway Engineering and Maintenance,* Chicago)

Address on The Relationship of the Purchasing and Stores Department to the Bridge and Building Department; by C. E. Smith, vice-president-purchases, N.Y.N.H. & H., New Haven, Conn.

Report of Committee on Protecting Men Against Accidents in the Use of Power Tools, F. H. Cramer, chairman (assistant bridge engineer, C.B. & Q., Chicago)

Luncheon—12:15 P.M.

Address by a prominent railway executive

Afternoon Session—2 P.M.

Report of Committee on Practical Measures for the Protection of Bridges and Buildings Against Fire, H. I. Benjamin, chairman (chairman, system insurance committee, S. P., San Francisco, Calif.)

Report of Committee on Meeting Today's Demands for Water Service, H. B. Christiansen, chairman division engineer, C.M.St.P. & P., LaCrosse, Wis.)

Question Box

Adjournment to visit exhibit of the Bridge and Building Supply Men's Association

Wednesday Evening—6:30 P.M.

Annual banquet of the Bridge and Building and the Bridge and Building Supply Men's Associations

Thursday, October 21

Morning Session—9:30 A.M.

Report of Committee on The Insulation of Railway Buildings, E. L. Rankin, chairman (architect, G.C. & S.F., Galveston, Tex.)

Business Session:

- Report of secretary-treasurer
- Report of auditing committee
- Report of obituary committee
- Report of Committee on Selecting Next Meeting Place
- Report of Committee on Resolutions
- Report of Committee on Subjects
- Election of officers
- Installation of officers
- Adjournment

Afternoon

Inspection of a huge industrial plant making material used by bridge, building and water service men.

Roadmasters Association

Indications point to a large attendance at the 52nd annual convention of the Roadmasters and Maintenance of Way Association, which will be held at the Hotel Stevens, Chicago, on September 14-16. The following is the program for the convention, all sessions being held on Chicago Daylight Saving Time (one hour faster than Central Standard Time).

Tuesday, September 14

Morning Session—10 A.M.

Convention called to order

Opening address by H. G. Taylor, Chairman, Western Association of Railway Executives

Greetings from the American Railway Engineering Association, J. C. Irwin, President

Greetings from the American Railway Bridge and Building Association, E. C. Neville, President

Address by President B. E. Haley (General Roadmaster, A.C.L., Lakeland, Fla.)

Report of Committee on Maintenance of Rail Joints, G. L. Sitton, Chairman (Chief Engineer Maintenance of Way and Structures, Southern, Eastern Lines, Charlotte, N.C.)

Afternoon Session—2 P.M.

Address on Curing Soft Roadbed by A. A. Miller, Engineer Maintenance of Way, M. P., St. Louis, Mo.

Report of Committee on Housing of Track Labor, J. A. Turner, Chairman (Roadmaster, A.C.L., Sanford, Fla.)

Adjournment to visit exhibit of Track Supply Association, followed by inspection of streamlined trains.

Tuesday Evening—7:30 P.M.

Question Box. For the consideration of questions submitted by members.

Wednesday, September 15

Morning Session—9:30 A.M.

Report of Committee on Trackman's Responsibility for Safety at Highway Crossings, E. J. Brown, Chairman (Roadmaster, C. B. & Q., Chicago)

Address on The Roadmaster's Responsibility for Tie Life, by H. R. Duncan, Superintendent Timber Preservation, C. B. & Q., and President, American Wood Preservers' Association, Galesburg, Ill.

Address on Building a Railroad for Today's Traffic, by H. S. Clarke, Engineer Maintenance of Way, D. & H., Albany, N. Y.

Afternoon Session—2 P.M.

Report of Committee on Good Practice in the Laying of Rail to Secure Workmanlike Results, L. E. Thornton, Chairman (Assistant Engineer, Alton, Bloomington, Ill.)

Address on Relationship Between Stores and Maintenance of Way Departments, by W. S. Morehead, General Storekeeper, I. C., Chicago.

Wednesday Evening—6:30 P.M.

Annual dinner given by Track Supply Association

Thursday, September 16

Morning Session—9:30 A.M.

Report of Committee on The Operation of Motor Cars to Avoid Accidents, M. Canavan, Chairman (General Roadmaster, U. P., Kansas City, Mo.)

Business session

Report of officers and of committees

Election of officers

Selection of 1938 convention city

New business

Installation of officers

Thursday Afternoon

Inspection of Chicago railway terminals

Supply Trade News

General

The Inland Steel Company has moved its St. Paul, Minn., office to new quarters in the First National Bank building.

The Chicago Pneumatic Tool Company has moved its sales and service branch at Buffalo, N.Y., to 128 W. Chippewa street.

Schramm, Inc., West Chester, Pa., is constructing a 25,000 sq. ft. addition to its main plant, of brick, glass and steel construction.

The Pettibone Mulliken Company, Chicago, was reorganized, effective July 1. Operations and personnel are continued by the **Pettibone Mulliken Corporation,** with the same headquarters.

Personal

Marvin Marsh, special Armco sales representative of the **American Rolling Mill Company,** Middletown, Ohio, with headquarters at Kansas City, Mo., has been promoted to manager of the newly created district office in that city.

R. J. Platt, assistant general sales agent of the **Sellers Manufacturing Company,** Chicago, has resigned to become general manager of the **Positive Rail Anchor Company,** with headquarters at Chicago, to succeed **A. H. Told,** whose death on June 25 was reported in the August issue.

G. F. Ahlbrandt and **W. W. Lewis** have been appointed assistant vice-presidents of **The American Rolling Mill Company,** and **H. M. Richards** has been appointed manager of the sheet and strip sales division. Mr. Ahlbrandt joined the Armco organization in 1904, as an open hearth chemist. He later became assistant open hearth superintendent and in 1909 entered sales work for the company, ultimately becoming general manager of sales.

Mr. Lewis came to Armco in 1917, as assistant open hearth superintendent. In 1922, he took up sales work and in 1925 was made manager of the London branch of Armco International Corporation. Returning to Armco sales headquarters in 1927, he was appointed assistant to the vice-president, in charge of commercial activities.

Mr. Richards joined Armco in 1913, as a clerk in the order department, later becoming assistant manager in that department. In 1916, he was made a salesman, and in 1924 was appointed district manager of Armco's Cleveland, Ohio, office, where he remained until 1931, when he was appointed assistant general manager of sales.

Self-Oiling Power Pumps—The line of Fig. 6150 simplex self-oiling power pumps manufactured by Fairbanks, Morse & Company, Chicago, is described in a six-page illustrated folder that has been issued by this company.

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The Low Cost BARCO WAY

★ This picture shows all that is needed for full efficiency on the whole class of tie tamping jobs: A roadbed, a man and a BARCO Portable Gasoline Tytamper.

The beauty of the picture is its simplicity—Nothing else to buy, to maintain or transport to and from the job.

The power and sure-fire operation of BARCO Tytampers is being demonstrated every day on a dozen major railroads. Equip gangs with BARCOS and watch track maintenance costs go down.

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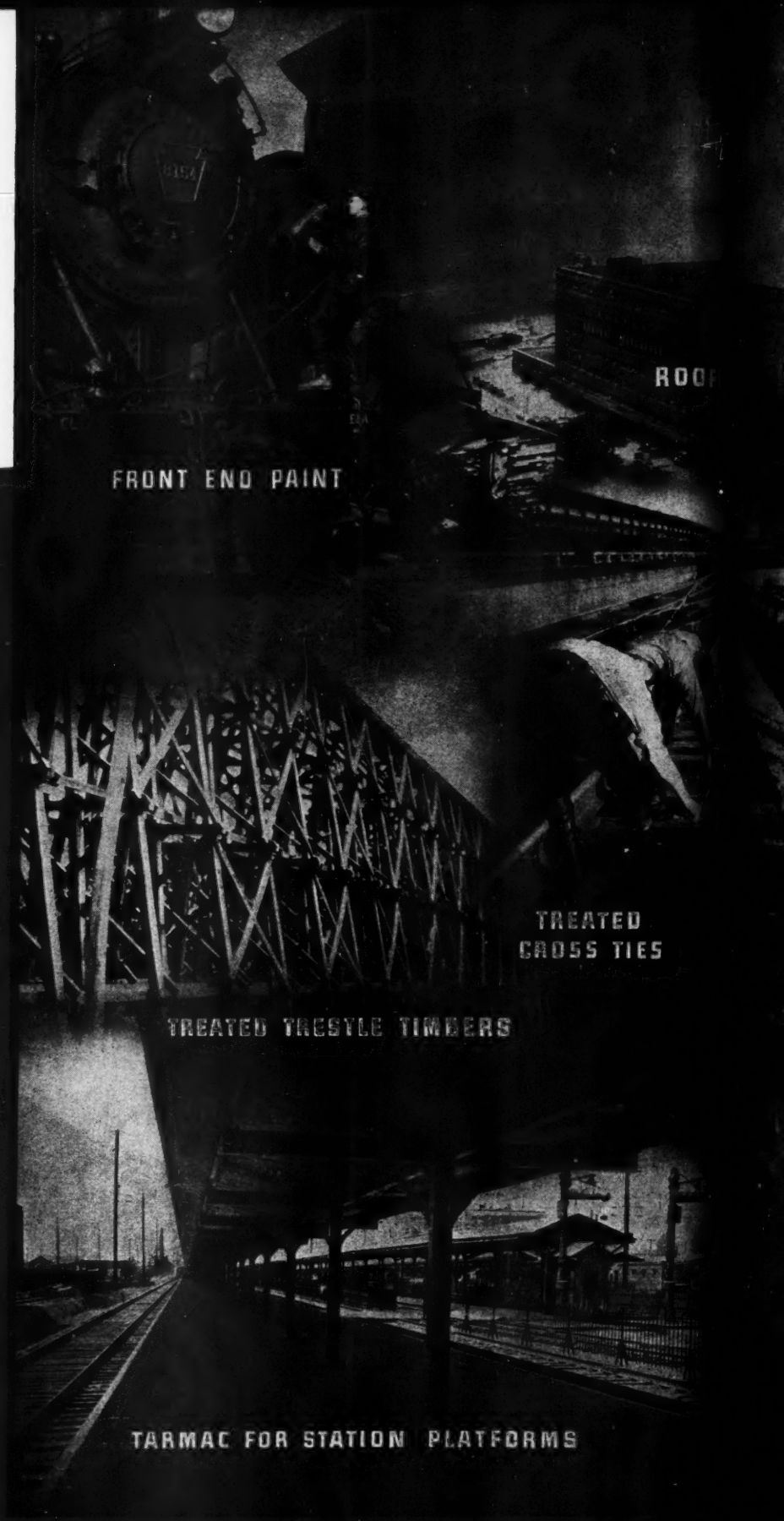

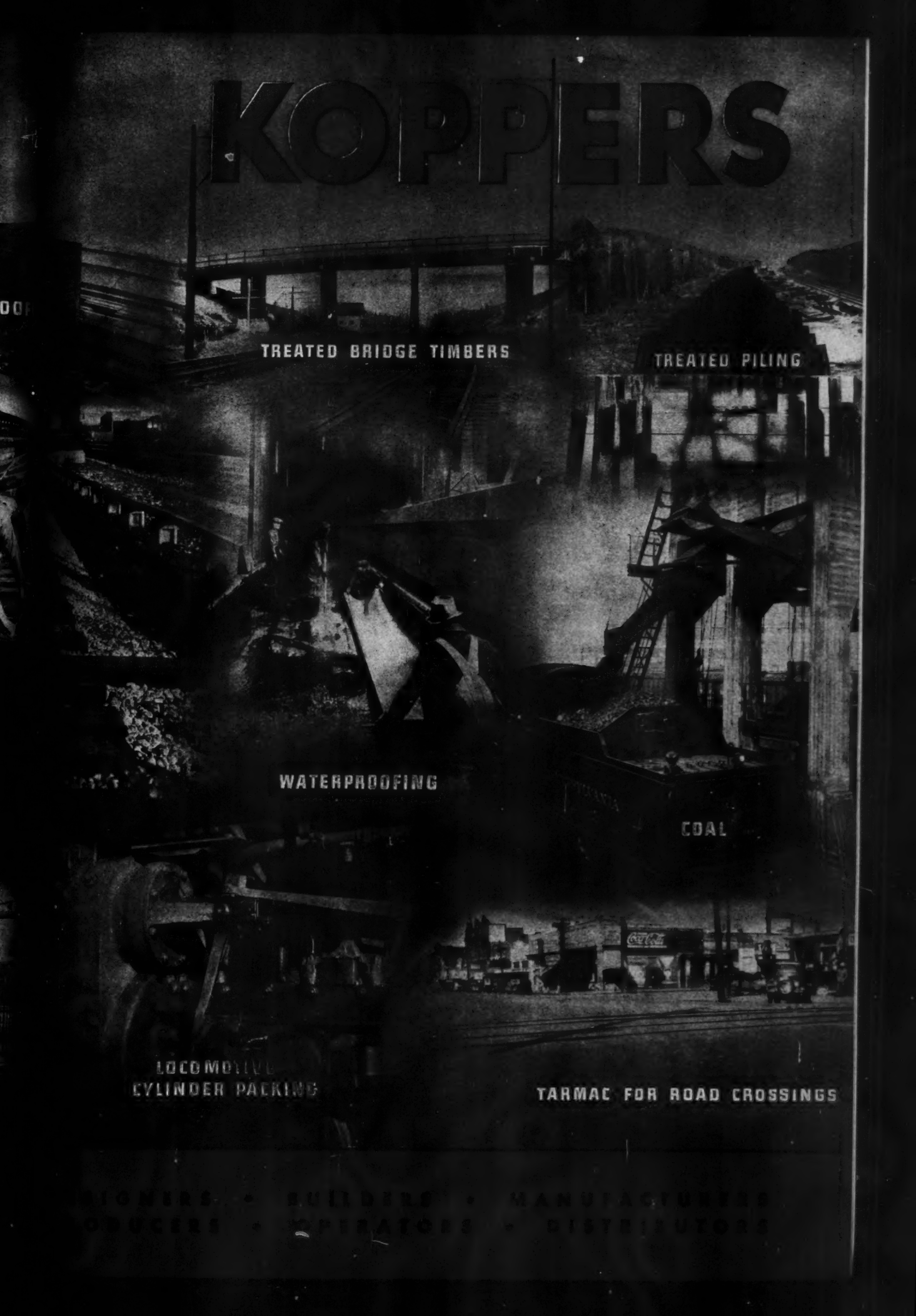
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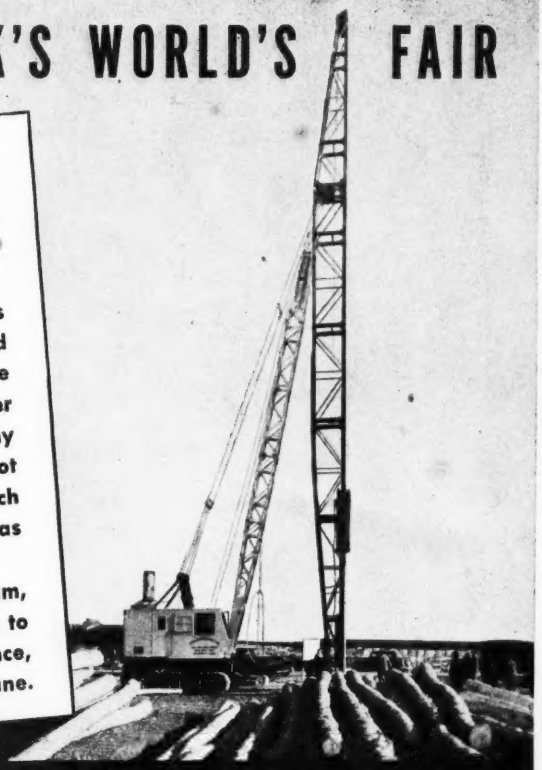
A Preview of NEW YORK'S WORLD'S FAIR

Bright lights and ballyhoo will come later but first an Industrial Brownhoist drives the piles for the footings of New York's mammoth World's Fair spectacle. The crane, a steam crawler, is equipped with leaders to drive piles up to 95 feet in length.

Industrial Brownhoist crawler crane design includes individual friction clutch for each motion; high and low speeds on both hoist and travel; an exclusive three-way steering with high or low speeds on either crawler belt while the other is, (1) propelled at any speed the operator requires, (2) held stationary to pivot the machine or (3) allowed to coast with both clutch and brake disengaged. No other crawler crane has such flexibility.

Industrial Brownhoist crawlers are built with steam, Diesel, gas or electric power and in capacities up to 25 tons. If you are interested in profitable performance, compare their design with that of any other crane.



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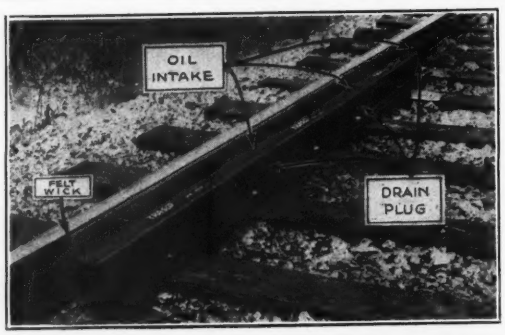

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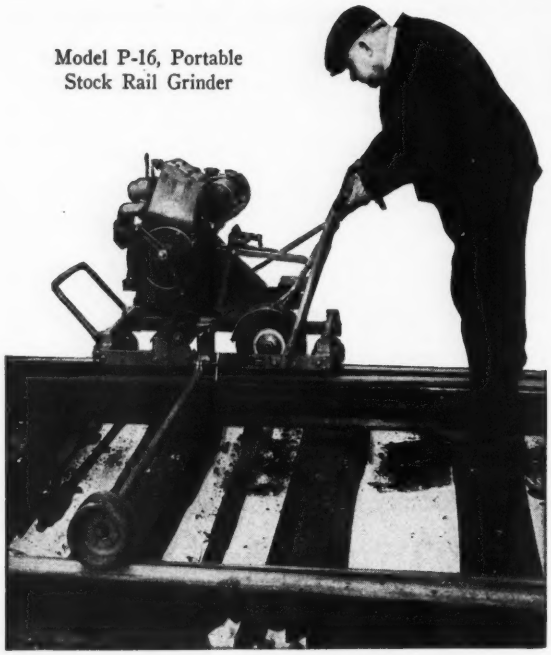

Model P-16, Portable
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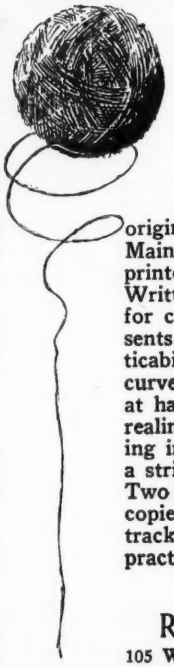

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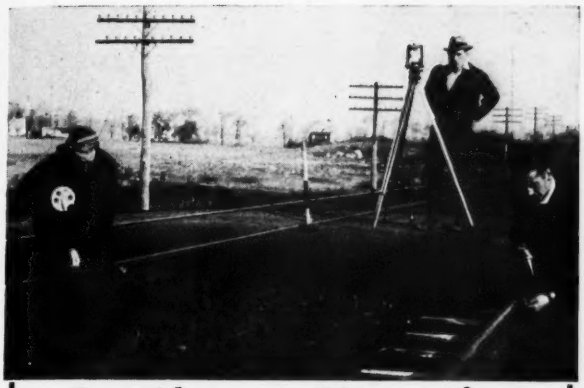

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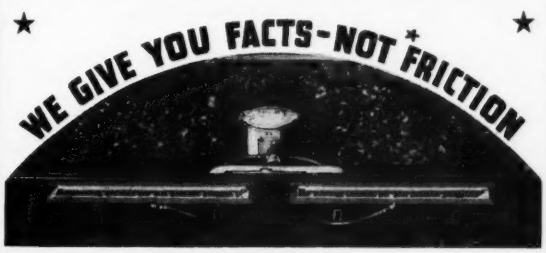

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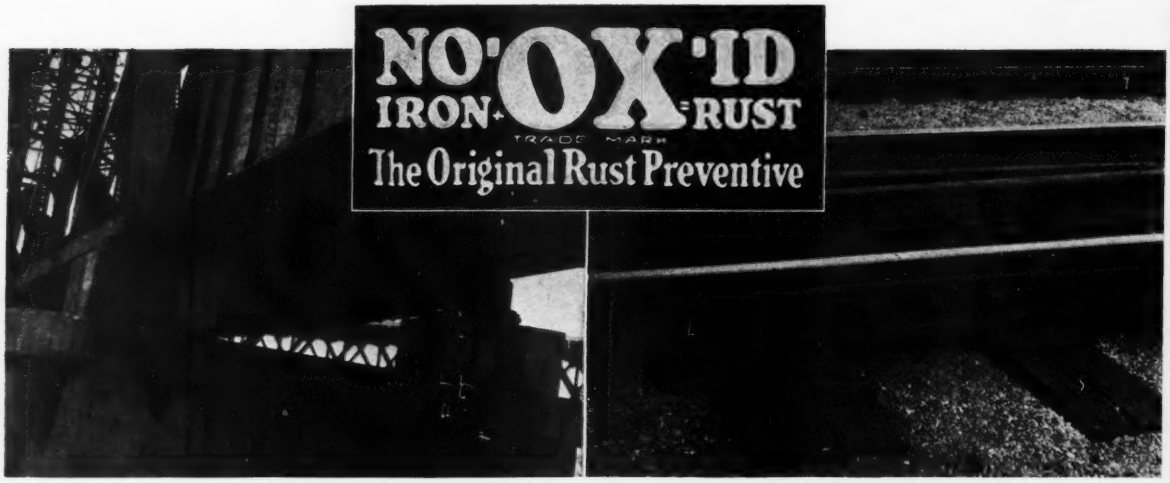

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